HYGIENE

PERSONAL & DOMESTIC.

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SCHOOL & HOME

BY

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1913.

DEDICATED

BY

GRACIOUS PERMISSION

TO

HER EXCELLENCY

THE LADY HARDINGE

OF PENSHURST

PREFACE TO SECOND EDITION.

THE Urdu edition of my little book published a few years ago having become exhausted I have now at the suggestion of the Punjab Text Book Committee brought out new editions in both English and Urdu.

Though much fresh material necessitated by advances in Hygiene, and especially in the prevention of disease, has been introduced, the actual compass of the work has been intentionally very little if at all altered ; and so it will continue, it is hoped, to retain its original design which was for use in schools and as a guide for the Health Missioner in the homes of the people of India.

The letter from the late Miss Florence Nightingale, a treasured possession, is now published for the first time—though written for the purpose as will be seen a good many years ago. Her views on the question of bringing health to the homes of India are, I believe, worthy of our sincerest consideration.

E. M. HENDLEY.

1913.

PREFACE.

In offering this little book to the Public of India it is hoped that a long-felt want may be supplied. The subject of Health is so all-important, not only to every individual, but to every nation, and is so intimately connected with the welfare and happiness of everyone living, that no apology is needed for endeavouring to place the very necessary knowledge of all things pertaining to our Domestic Health within the easy comprehension of all. Doctors and sanitarians are responsible for enforcing the Laws of Public or State Hygiene, but their work can never be anything but an up-hill task —especially in a hot climate like India—unless *every* member of *every* household recognises his own responsibility in Domestic Hygiene.

E. M. HENDLEY.

August, 1893.

October, 1894.

MY DEAR MADAM,

All that you have so kindly told me about the native poor in the Punjab and their sanitary or insanitary habits and surroundings has so deeply interested me.

You ask me to write you a few words upon what is to be done. It seems to me there is one thing needful—is there not ? namely, that educated women should be instructed by a Medical Officer well versed in native sanitary things, so as to teach them, the native women, in their own homes what to avoid and how to avoid it, the ladies to be instructed in Physiology as in Hygiene,—that an essential part of the instruction is that they should be taken by the Medical Officer into the very homes of the poor, so as to see with his help what is wanted, that with his help they may become Health Missioners among the native mothers.

This has been tried in England. But of course the difficulty is much greater in India : because in England the ladies can go direct into the Cottage homes, whereas I am told from other parts of India where the plan has been mooted, that to reach the native poor, the Health Missioners must be native women themselves, instructed perhaps by the ladies—Is this so ?

Health Missioners must of course know native languages, habits and religions. They must be full of tact and sympathy as well as of practical skill and knowledge to make themselves acceptable so that the poor house mothers may invite these Missioners to their homes.

These and many other questions must be practically answered by you and all those who like yourself are deeply penetrated with the necessity of sanitation among the poor of India. It is not for me to advise.

And I wish you God-speed in your noble task from the depths of my heart.

Pray believe me ever yours sincerely and sympathizingly.

FLORENCE NIGHTINGALE.

MRS. HAROLD HENDLEY.

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ELEMENTARY PHYSIOLOGY.

CHAPTER I.

PHYSIOLOGY—ANATOMY—THE SKELETON—LONG, FLAT AND IRREGULAR BONES—THE SKULL—THE SPINE—THE PELVIS—JOINTS—MOVEMENTS OF JOINTS—MUSCLES.

Introduction.—Before we can possibly understand why so much importance is attached to the Laws of Health, and why we ought all to have a knowledge of them, as much for our own welfare as for that of others, we must learn something about how beautifully and wonderfully we are made, and how it is often very simple to prevent ourselves getting ill or even weak.

There are many things we know about ourselves without being taught, as for instance, that our bodies consist of a head, trunk and limbs, that we have bones and flesh and blood, and a skin which covers the whole of our body; but there are others which must be learned, if we are to understand how it is that the food we eat is changed into blood and flesh and bone and nerve and muscle, or that the air we breathe

into our lungs changes and purifies the blood of our whole body.

Physiology.—This knowledge is called Physiology, and Physiology therefore means the study of the working or functions of the different parts or organs of our body.

Anatomy.—The study of the way these different parts or organs are put together is called Anatomy, and to be able to understand the Laws of Health we must learn a little about both, that is, how our bodies are made, and how the different parts work.

Bones.—The Skeleton.—First of all we must learn something about our bones, and the way they are joined together, to form the Skeleton, which is the frame-work and support of our flesh.

We have 200 bones in our body, and they are of many varying shapes and sizes according to their uses. There are long bones and flat bones and irregular bones, and they are all designed so as to be as light and strong as possible.

Long bones.—Thus the long bones which we find in our arms and legs are not solid pieces of hard bone, but are made up of a circle of hard compact bone outside a second circle which is soft spongy bone inside, and within these two a hollow which is filled with marrow, like the white substance one can see in the hollow of meat bones.

Flat bones.—And again the flat bones which are in our head and face are not flat solid pieces of hard bone, but they are made up of two plates of solid hard bone with sponge-like bone between them.

The Skull.—Twenty-two of these flat bones form the skull, which is a very strong and yet light structure containing the brain and our senses of seeing, hearing, smelling and tasting. Without the brain we could not think or reason, and without our other senses we could neither enjoy life ourselves, nor work for the good of others. It is therefore not surprising that the skull is very strongly made, and that it should be round or arched at the top instead of flat, because an arch is the strongest of all shapes, each part supporting the other by pressing against it. If the skull were not so strong, people could not carry such heavy weights as they do on their heads.

In the skull of a baby it is easy to see how these bones join and fit into each other, for they are not quite hard and well joined together until a child is seven years old. The reason is that a baby's brain has to grow, and the bones have to grow too, to cover the brain as it gets larger. Every one should therefore be careful not to press or hit a child's head, as they may harm the brain.

The Spine.—Irregular bones.—The skull which, as we have seen, is made up of flat bones, rests upon a column made up of the irregular, or third kind of bones. This column is made up of 33 bones called the Vertebræ, which form what is called the spine or spinal column.

These bones are also very strong, not only because they are the backbone, or support of the back, but because they have to protect the spinal cord which is nerve matter, very much

like the brain. To prevent the bones jarring our nerves when they move, there is a wonderful little pad of gristle between each of these vertebræ, and in two of the vertebræ in the neck there is still something more to remember—for there we find one bone with a spike of bone shooting up from it and passing through a hole in the vertebra just above—a very simple contrivance, but one that enables us to turn our head from side to side.

The Pelvis.—Another kind of irregular bone is seen in the haunch bones which join the backbone and form what is called the Pelvis—that strong basin of bone which is at the lower part of our body, and which rests on our thigh bones, protecting and supporting all the organs in the belly or abdomen.

The Ribs.—Again another kind of long or curved bone is seen in the ribs which are fastened to the spine at the back and to the straight breast bone in front. Their work is to protect our lungs and heart and to help us in breathing.

Joints.—When two or more bones meet together they form what is called a joint. Now just as there are three kinds of bones, there are three kinds of joints :—

(1) the fixed,
(2) the mixed,
(3) the movable.

We have fixed joints, that is, joints that do not move, in the skull bones.

We have mixed joints, or joints which cannot move very much, in the spine, and between the collar bones and the breast bones.

Movable joints.—And lastly we have movable joints in our fingers and toes, our hands and arms and legs. The movable are really the true joints, and they consist of two bones which fit one into another and are bound together by strong ligaments or binders. All these true joints are alike in one thing—they all have a soft piece of gristle or cartilage over the top of each bone, and all have a little bag of fluid between the two bones that meet. The fluid bag is like oil to the joint, as well as like an air cushion between, and the bag and the gristle together prevent the bones from jarring. But these joints are not alike in the way they move. In all true joints the bones *glide* or move smoothly one over the other, and in the case of the wrist and ankle bones this is all they can do, but the elbow joint, the knee joint and the finger joints can all move like hinges, that is, they move at an angle, and these are called hinge-joints.

Pivot joints.—In some other joints, as for instance between the first and second vertebræ, and the two bones of the lower arm between the elbow and the wrist, one bone turns round upon another and these are called Pivot-joints.

Ball and Socket joints.—In others, one bone with a round head fits into another with a hollow or socket, like a ball into a cup. These are called Ball and Socket joints, and we can move them more than any other kind of joint. Our shoulder and our hip joints are joints of this kind, and as we know, we can swing our arms round in a circle, straight out from the shoulder, besides bending them different ways.

The Muscles.—Now we know how our joints are bound together, and all the different ways they can move, we have to learn about our muscles, which make us able to move our bones and our joints. Our bones cannot move by themselves, they only move when the muscles fastened into them grow shorter or longer according to what our brain tells them.

Now what are these muscles ? They are simply bundles of strong fibres, or threads of flesh, bound round with a tough membrane or skin.

Tendons.—The ends of this strong, tough membrane of the muscles are generally fixed into bones, and we call them tendons or sinews. Now muscle is very elastic, and when we wish, we can make it shorter or longer, just as we can stretch a piece of elastic in our hands.

When we want to draw up our arm, our nerves which we shall learn about afterwards, carry a message from our brain to the nerves round the muscles of the arms, and the muscles immediately contract, that is, grow thicker and shorter, and so bend the joint.

Voluntary Muscles.—Involuntary Muscles—All muscles that are attached to our bones are under the control of our will, and so are called voluntary muscles ; but there are others which continually contract and relax without our thinking about them, and these are called involuntary muscles. All the muscles of the stomach, the heart, and the lungs, and several other parts of us, are involuntary, but these we shall learn about later on.

CHAPTER II.

NUTRITION—THE ORGANS OF DIGESTION—MUCOUS MEMBRANE—THE STOMACH—GASTRIC JUICE—CHYME—THE DUODENUM—BILE AND PANCREATIC JUICE—CHYLE—VILLI—LACTEALS—RECEPTACLE OF THE CHYLE—LARGE INTESTINES—THE VERMIFORM APPENDAGE—UNDIGESTED FOOD.

Nutrition.—We have now to learn about Nutrition and the organs of Digestion, that is, how our body is nourished, and all that happens to our food after we have eaten it. It is easy to imagine that there must be a great many changes required, before a dish of rice, or a roast fowl, or a piece of bread and butter, or in fact anything we eat, becomes changed into the blood which pours into every part of the body, giving flesh where it is needed, repairing muscles and nerves and bones, carrying away all that is not wanted, or used up, and generally keeping us alive.

The Mouth.—The Teeth.—The Saliva.—Mucous membrane.—These changes that the food undergoes are very wonderful, and also very interesting. In the first place a great change is made when food goes into the mouth. There, as we know, are our teeth to masticate it with, our tongues and the insides of the cheeks, to roll it from side to side until the teeth have bitten it well up, and some fluid which is called

Saliva or Spittle. This Saliva comes from six little glands lying along each side of the mouth. These glands, the same as those in our stomach, and other parts of our bodies, are simply little depressions or hollows in the mucous membrane and the mucous membrane itself is the fine pink skin that lines all the inside of our mouths, and in fact of all our bodies. Membrane means fine lining or tissue, and the lining skin of our bodies is called "mucous" because it is always giving out a kind of moisture which is called "mucus."

First change in our food.—Starch becomes sugar.—Babies' digestion.—The Saliva coming from the mucous membrane of the mouth causes the first great chemical change in our food, since it instantly changes all starch into sugar—not cane sugar but another variety called grape sugar, which is a soluble form of sugar. There is a great deal of starch in most of our foods, in bread, in rice, in *chapatties*, in potatoes, and in all puddings, or cakes made with flour, and although when it is cooked, it becomes a kind of sticky fluid, still it is not perfectly fluid enough to pass through the walls of the food canal into our blood. But sugar can easily pass through into the blood, so we can understand that the Saliva is very important, because it changes all starch into sugar for us. Babies, we must not forget, do not have Saliva until they begin to cut their teeth, when we see they begin to dribble, so that if rice, or arrowroot, or bread or *chapatties* or cornflour is given to a very young baby, it has nothing in its mouth to

change the starch into sugar, and so its food cannot pass through into its blood, and the child therefore gets no nourishment from its food.

It is very wonderful to think that directly food goes into the mouth, the Salivary glands begin to pour out their useful fluid, and that when they begin their work they stimulate the stomach to pour out its particular fluid, which we call gastric juice. In this way when the food is finished with in the mouth, and we swallow it, it goes down the gullet into the stomach, and there finds further changes in store for it.

The Gullet.—The gullet which is between the windpipe and the backbone, is a soft tube with muscles which press the food on and down. It is these muscles which enable a juggler to drink a glass of water when standing on his head, and these also which enable horses and other animals to eat and drink with their heads down, for they have a gullet like ours.

The Stomach.—The food is not changed in the gullet, it merely passes to the stomach, which is a kind of elongated bag with two openings, one for the food to enter from the gullet, and one for the food to pass on into the intestinal canal or bowels. The stomach is placed just below the Diaphragm and to the left of the body.

The Diaphragm.—The Peritoneum.—The diaphragm is a strong muscle stretching right across our bodies. It helps us in breathing, and it also divides the chest which contains the heart and lungs (Fig. 2), from the abdomen,

which contains the stomach, liver, kidneys, bowels, &c. And here in the abdomen, just as between our joints, we find a bag with fluid in it, to prevent our organs pressing or jarring one against the other, when we take exercise or move about. This bag, which is called the peritoneum, is fastened to the Diaphragm and to the walls of the abdomen on all sides, and is attached to and holds up and forms a covering to the Stomach and Liver, the Pancreas, the Spleen, the Kidneys and all the folds of the Intestines.

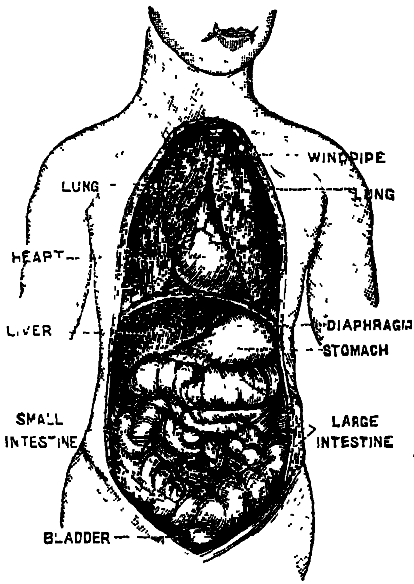


Fig. 2.

Coats of the Stomach.—Now we have to learn how the stomach is made, and how it works on our food. The stomach then, as we said, is a kind of elongated bag, but it is a bag with three coats, an outer, middle and inner, and each coat is made up of a different kind of muscle.

(1) The outside coat is a muscle with downward fibres for shortening the stomach.

(2) The middle coat has circular fibres for narrowing it.

(3) The inner one has oblique fibres for drawing the sides of the stomach over the food. 65/6

The work of the Stomach.—Chyme.—The stomach, therefore, is like a big muscle which is able to work all ways at once. When food goes into it, it contracts all its muscles, and so moves the food up and down, and from side to side. At the same time the gastric juice pours out from the mucous membrane lining the stomach, and helps to dissolve the food, until all the solid part of it is like a smooth, thin paste, or like *congee*, that is until it has become Chyme. *Chyme* consists chiefly of the dissolved parts of meaty foods called peptones which can pass direct through the mucous membrane of the stomach and so into the blood, and also largely of undigested fat in the form of tiny globules which have only had their shells or cells broken by the gastric juice. The peptones are so called because they have been dissolved by the pepsin one of the chief principles of the gastric juice, and when one speaks of peptonized food, it simply means food artificially digested by pepsin. Three things help to make this change.

(1) The contractions of the stomach.

(2) Its heat.

(3) The gastric juice which with its pepsin and hydrochloric acid is a very powerful acid fluid, strong enough to dissolve metals, such as iron or silver, and therefore strong enough, as one can imagine, to break up all the solid parts

of our food, such as fish, meat, or the gluten of wheat and the white of egg.

We must remember, however, that the casein or nitrogenous part of milk is curdled or coagulated by the gastric fluid, and thus becomes solid before becoming dissolved. This explains why milk cannot frequently be digested in certain illnesses where the secretions of the stomach are altered or weakened, as for example, in enteric fever and in many infantile complaints.

However, although the stomach does a great deal to dissolve the food, it does not finish the work of digestion, because it cannot change the fat or oily part of our food, so that it will mix with water, or can be made into blood. Now we shall see how this is done.

The Duodenum.—When food has become chyme in the stomach, the entrance into the intestines which is closed by a muscle whilst the stomach is at work, opens and allows the chyme to go into what is called the duodenum, a part of the intestinal canal so called because it is the breadth of twelve fingers. Into this duodenum flow two fluids, one from the pancreas or sweet bread, called pancreatic juice, the most powerful digestive fluid in the whole body; the other from the liver, called bile, a very strong antiseptic.

The Pancreatic juice.—The pancreatic juice is very much like Saliva, and its work is chiefly to finish dissolving any starch that may still remain unchanged into grape sugar, but it also does two other things. It helps to split up or divide the fats in our food, and to digest any of

the solid parts of our meat or food which have not been broken up by the gastric juice.

The Bile.—Fats in food changed.—Chyle.—The bile is very like a strong soap, and its work is to (1) moisten the mucous membrane, (2) to act as a natural purgative, and (3) to make the fat or oily part of our food mix with water. We know that if we pour some oil into a glass of water, the oil will float but will not mix. But if we put soda, or strong soap in with the oil and water, they will soon mix. Now in the bile there is a kind of soda, to change the fats we have eaten into a soapy substance which will easily mix with water. This, we must remember, is the third great change our food undergoes during digestion, and after it, it is no longer called Chyme but Chyle. Now we have traced the chyle, or milky white substance into which our food has been turned, to the first part of the intestines, we must see what becomes of it.

The Small Intestines.—The Villi.—Lacteals.—Receptacle of the Chyle.—The small intestines which are divided besides the duodenum into the jejunum and the ileum and are four times the length of the body are not simply smooth tubes inside and out, but on the contrary are lined with a mucous membrane puckered up into an immense number of folds, and every fold has hundreds of little projections like the pile of velvet. These little projections, called Villi absorb or take in the food or chyle as it goes squeezing by them through the whole length of the intestines. From the Villi, the chyle

passes to quantities of little tubes called "Lacteals," or "Lymphatics," which carry the milky fluid to the back of the intestine, to what are called the lymphatic glands. And in these glands another wonderful thing happens, for about half the chyle gradually changes into little round bodies called corpuscles, which float along with the chyle until both are emptied into a canal or tube, which lies close to the spine, just below the diaphragm, and which is called the "Receptacle of the Chyle." A tube about the size of a goose quill then carries it up to a vein in the neck, and from this vein the food, which has now become blood, is carried into the heart.

We now know how the food we eat is changed into chyme and chyle, and afterwards blood, but we must not think that all our food becomes blood. It is only that part which is really digested, that is, becomes a milky fluid that is taken up by the villi,—all the rest passes on all through the small intestines until it comes to the large intestine, where a valve consisting of two folds of the mucous membrane closes on it, and prevents it coming back. These folds project into the large tube, and thus form a valve between the ileum and the cæcum, which is known as the ileo-cæcal valve. Close to this is the little worm-like projection on the large intestine called the vermiform appendage. This opens at one end into the cæcum, but is closed at the other and sometimes it becomes clogged and inflamed, giving rise to the disease known as Appendicitis.

The Large Intestine.—The Rectum.—The large intestine contracts and expands just in the same way as the small intestines, or the gullet, and in this way pushes the undigested and waste substances of the food on until they reach the rectum, which is the end of the food canal, and is closed by a strong voluntary muscle. This muscle only relaxes at will, when it is necessary to get rid of the waste matters, or in other words the solid excreta from our bodies.

We now see clearly that food is digested or dissolved as follows :—

Salts and sugar are dissolved in the mouth or stomach.

Starch is changed into grape sugar in the mouth and intestines.

Meat and other nitrogenous bodies are turned into peptone in the stomach and intestine.

Fats are broken up so small in the intestines that they become capable of being absorbed.

Food is thus absorbed :—

Partly by the capillaries of the stomach and intestines, but chiefly by the lymphatics in the walls of the intestines.

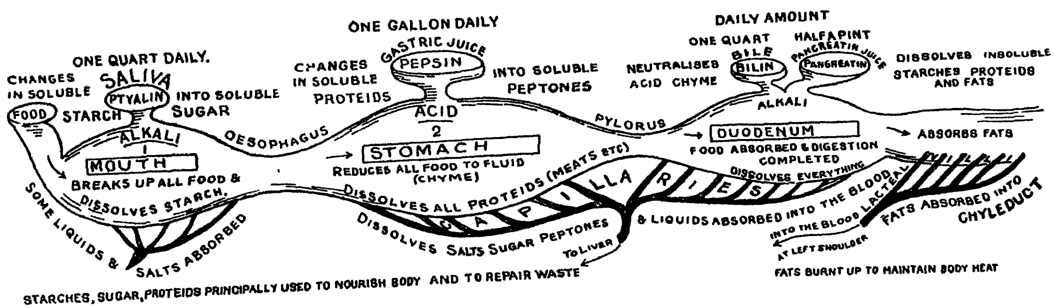


Diagram to explain the processes of digestion and absorption—the amounts of juices used daily, their action and effect upon food,

CHAPTER III.

CIRCULATION OF THE BLOOD—THE HEART—PERICARDIUM—AURICLES—VENTRICLES—AORTA AND LARGER CIRULATION—VALVES—CAPILLARIES—VEINS—RIGHT AURICLE—PULMONARY ARTERY AND CIRCULATION—PURIFYING OF THE BLOOD IN THE LUNGS—THE BLOOD—THE SPLEEN—COAGULATION—USES OF THE BLOOD.

Now that we have learnt how our food becomes changed into blood, and how the new blood after every meal we eat is carried to the heart, we must see how it is distributed all over the body.

The Circulation.—In the first place then it goes into the heart, and from the heart it goes into tubes called arteries, which carry it away from the heart, next it goes into very fine vessels called capillaries, because they are as fine or finer than hairs, and from the capillaries it passes into tubes called veins, which carry it back to the heart. This is what is called the circulation or going round of the blood. Now what is the heart and what does it do with the blood ?

The Heart.—The Pericardium.—The Septum.—Auricles.—Ventricles.—The heart is a very powerful pumping machine which is placed in the chest, rather to the left side of the line of

the breastbone, and about the same size as the closed fist of its owner. Thus a baby's heart is as big as a baby's fist, and a man's heart as big as a man's fist. All round the heart is a bag of membrane folded on itself called the Pericardium, which contains fluid and protects the heart, just as the peritoneum protects all the organs in the abdomen. The heart is divided into two distinct halves, by a partition going from top to bottom, called the Septum, which entirely separates the blood on either side of the heart and prevents it mixing (Fig. 3). Each half of the heart is again divided into two chambers, the upper ones called auricles because they have little *ear-like* appendages, and the lower ones called ventricles, and blood can go from the left auricle into the left ventricle, or from the right auricle into the right ventricle, which is just underneath, but cannot go back from a ventricle to an auricle until it has circulated through arteries, capillaries and veins, and undergone many changes.

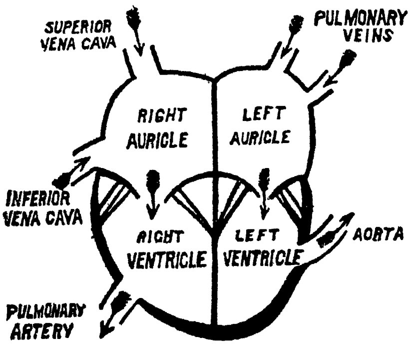


Fig. 3

Circulation from the Left Auricle.—Bicuspid Valve.—Now the heart is really an involuntary

muscle, through which blood is being continuously pumped and which acts day and night until we die. When the heart is contracting it is working and when dilating it is at rest, alternate work and rest. Let us begin with the left side of the heart, and imagine we see the left auricle is full of blood. In an instant that blood has passed through into the left ventricle, and the small tooth-shaped valve, called the Bicuspid, or Mitral valve, which hangs from a fibrous ring in the opening, has closed over it. Then what happens? These valves, which are like little doors, are held closely shut by small cords like catgut, that fasten them to the wall of the ventricle, and at the same time the ventricle, which has a strong muscular wall, presses the blood on all sides. We know that it cannot get back, then where does it go? It goes forwards into the largest tube for carrying blood that there is in the body.

The Aorta.—Semilunar Valves.—The Pulse.—This is called the Aorta, and starts in a big curve upwards from the heart, like a great hook. Directly the blood is squeezed through into the Aorta by the contraction of the ventricle it is forced to pass on; for when it tries to get back three little pouches shaped like half moons called the semilunar valves, are pressed back by it and cut off all further return. Each time the left ventricle pumps blood into the Aorta it sends about 2 *chittacks*, or four wine-glassfuls, and as the Aorta is always full, one can easily realise that as its walls are constantly expanding and contracting it presses the blood on in little

wavy jerks or shocks, and it is exactly these shocks or beats which can be felt when the arteries are near the skin as in the temples and wrist and form what is called the "Pulse."

Branches from the Aorta.—Now we must find out where the blood in the Aorta goes to. Soon after it has passed the curve three branches or arteries are waiting to be fed with blood.

(*a*) Goes to the right and soon divides into two branches, so as to give one to the right arm and one to the right side of the head.

(*b*) Goes to the left side of the head.

(*c*) Goes to the left arm.

The work of these three branches, it is easy to see, is to carry blood to all the upper part of the body—the head and face, the neck, arms and shoulders.

Branches to Organs.—Arteries.—Capillaries.—Now the Aorta after giving off these branches and thus getting rid of some of its contents, does not stop. Its work is not yet done, and if one follows it, one sees that it goes down the body close to the left side of the spine, that on its way it again gives off branches to the stomach, the liver, the kidneys and other organs, and when it has given off enough for the supply of all the inside of the body, it divides into two great arteries, thus sending one to each leg. Now if we trace any one of these big arteries, no matter whether it goes to the head, or the arm, or the stomach, we find the same thing always happening—that is, the big artery continually dividing up into branches, and these branches again into smaller branches, until the artery ends

by spreading out like a tree with hundreds of feathery branches. Then all these little branches divide and divide, and get smaller and finer, until they end as capillaries. These capillaries are finer than a hair, and when we put them under a microscope we see they are only the $\frac{1}{3000}$ of an inch across. As the blood gets down into the finer arteries, it gradually grows slower and slower and loses its wave-like movement, until in the capillaries, and afterwards in the veins, it flows at an even rate.

Perhaps some one is wondering by this time what is the use of all these capillaries, and why the arteries should take all their blood to them.

Work in the Capillaries.—Loss of red Colour.—Oxygen.—Carbonic Acid Gas.—The reason is that when the blood gets to these very, very fine tubes, their walls are so thin that the blood can pass through them, repairing a piece of muscle in one place, a piece of nerve in another, adding new blood to something else, so that it may grow larger, and at the same time sweeping away all that is worn out, or old, or has done its work and must be got rid of. All this is done as the blood flows through the capillaries, and it makes a great change in the colour of the blood. When it started from the left auricle and in fact all the time it was travelling through the arteries, it was a bright red colour, but when it has done its work in the capillaries it is so full of waste materials and things which have to be got rid of from the body in order to keep us fresh and well and clean inside, that it is a dark inky colour. This change in colour

is caused by the blood not only being full of waste materials, but by its having lost a pure gas called Oxygen, and received in exchange an impure one called Carbonic Acid gas, which is poisonous to us when we get much of it.

Now we have to see how the blood gets pure and clean again.

The Veins.—Valves of Veins.—First then from the capillaries it goes into the veins, and the veins take it all back to the heart. We all know how blue our veins look under our skin, and now we know that it is because the blood in them is inky and not red. There are one or two things to remember about veins.

One is that every big artery, and every little branch of an artery, has a special vein running alongside to take back the blood from its capillaries.

Another is that all veins are fitted with little valves which let the blood go past towards the heart, but which close so as to prevent it going backwards. When people get what are called "varicose" veins, it means that these little valves have got weak and cannot do their work properly.

And a third is, that all the veins in the body gradually unite and unite into bigger veins, until they form two only, one of which brings all the blood from the legs and lower part of the body, whilst the other brings all the blood from the head, neck and arms and upper part of the body.

The Right Auricle.—Tricuspid Valves.—These two veins then empty their blood into the right

auricle, and from there it starts on a new journey, but this time it only goes through the lungs and not over the whole body. From the right auricle it passes through into the right ventricle, and a valve—this time with three points and so called tricuspid—prevents it going back, just as the bicuspid valve did on the left side of the heart.

Pulmonary Circulation.—The right ventricle contracts and the blood is forced into the Pulmonary, or lung artery, which, we must remember, is the only artery in the body that carries impure blood.

Pulmonary Artery.—Lung capillaries.—Change in the colour of the blood.—Pulmonary Veins.—Left Auricle.—The Pulmonary artery has three little half moon valves like the Aorta, and divides first into two branches, one for each lung. These branches divide up in the lungs like all other arteries, until they end in capillaries. And in these, as in the capillaries all over the body, a wonderful work goes on, though it is of a different kind. These capillaries, we must understand, wind about in a close net-work all over the tiny air sacs which make up our lungs, and directly the impure blood in these capillaries comes into contact with the fine walls of the air sacs it makes a marvellous exchange —it throws away the poisonous carbonic acid and takes in all the pure oxygen it can. The oxygen has just come from the fresh air we have breathed into our lungs, so it at once changes the colour of our blood back to bright red, fresh and clean and clear, and it flows swiftly along,

away from the capillaries, and so into the pulmonary or lung veins, the only veins remember that carry bright *red* blood. And when these veins carry the blood back to empty it into the heart they take it to the left auricle which as you know we started from, and from this of course it starts on another circulation.

Now that we have learnt all about the way the blood travels or circulates in our bodies we must learn what blood is.

Blood.—Corpuscles.—Blood then is a pale straw coloured fluid with millions of little bodies called corpuscles floating about in it. These copuscles are of two kinds, red and white, but there are many more red than white, and so they give the blood its colour.

The Spleen.—Some of these corpuscles, we remember, were formed in the lymphatic glands of the intestines after every meal we eat, but it is only a few that are formed there. Most of those in our blood are manufactured in the spleen. The spleen which is the largest of what are called the "ductless" glands, that is glands which have no tube leading from them, is found between the stomach and the ninth, tenth and eleventh ribs, and when enlarged can be felt just under the left side of the lower border of the ribs. It is really a great blood gland which swells out after every meal, when it is supposed to be busy at its important work of manufacturing white corpuscles for the blood. But besides being the birth-place and nursery of most of the white corpuscles of the blood, it is the graveyard, or destroyer of some of the red corpuscles.

This is perhaps the reason why the spleen becomes enlarged when people suffer from malarial fever or ague.

White corpuscles.—We said that there were two kinds of corpuscles, the red and the white. Now what are they each like? The white corpuscles are much larger than the red, and are not round but all kinds of irregular shapes, with one or more smaller bodies inside them. There are only about three or four of these corpuscles to every 1,000 of the red, and the reason of this is that they are continually disappearing, for they are always either dying in the blood or giving birth to red corpuscles.

Red corpuscles.—The red corpuscles themselves are very tiny disc-shaped bodies rounded at the edges, a little thinner through in the middle than the outside, and very elastic. They are so tiny that 3,200 would lie along an inch, and there are so many of them, that it would take over a thousand years, counting a hundred a minute, night and day, to count the number in one cubic inch of blood.

Coagulation of the Blood.—There is one more thing to remember about the blood, that is that though it is always liquid (like water) when in our blood vessels, it forms a thick clot directly it runs out of its proper tubes. This is due to the formation of fibrin which is never present while blood is in the body; it is called the "coagulation" of the blood. It is a thing we may see any day when a finger is cut. The blood, we may notice, after coming out fast for a little while, begins to look thicker, and at last

forms a solid plug over the place and so stops the bleeding.

Uses of the Blood.—The chief uses of blood are as follows:—

1. It is a storehouse for the nourishment absorbed from our food and carries this nourishment to all parts of the body.

2. It carries materials from which the secretions are formed to the various glands which prepare them.

3. It carries Oxygen gas everywhere where oxidation or burning is going on so as to keep up the heat of the body.

4. It collects up waste materials and carries them to the excreting organs for separation and removal.

5. It serves to distribute heat throughout the body.

6. It bathes every part of our tissues.

"A wonderful fluid indeed is the blood—though it is the same blood which is rushing through all the capillaries it makes different things in different parts. In the muscle it makes muscle—in the bone, bone—in the nerve, nerve—and in the glands, juice, and though it is the same blood it gives different qualities to different parts—out of it one gland makes saliva, another gastric juice—out of it the bone gets strength, the brain power to feel, the muscle power to contract."

CHAPTER IV.

RESPIRATION—THE WINDPIPE—CILIA—BRONCHI AIR-CELLS—PLEURA—DIAPHRAGM—RIB MUSCLES—INSPIRATION—EXPIRATION—EXPIRED AIR—CARBONIC ACID GAS—WATERY VAPOUR AND ORGANIC MATTERS.

Respiration.—In the last chapter we learnt that when our blood travelled through our lungs it was changed from its inky colour to a bright red. This change takes place every time we breathe in air, so now we must learn all about our respiration or breathing. Now how does the air we breathe through our nose and mouth get to our lungs, which are packed away in our chest, with rib bones and muscles keeping them out of sight? There must of course be a tube from the mouth to the lungs, and there is one which we can feel, running down the front part of the neck.

The Windpipe.—Epiglottis.—This is called the windpipe, that is the pipe for carrying the wind or air. At the top of it there is a little door called the Epiglottis which is always open to let air go through except when food is going down the throat and then it is closed. Sometimes when people eat quickly, or speak when they are eating, a little food gets under the epiglottis and then they cough because the windpipe refuses to let it go down.

The Windpipe.—Cilia.—The windpipe, if we look inside it, is not like the other pipes or tubes.

we have learnt about, for it is not muscular or elastic but it is made up of a lot of little gristle rings shaped like a C fastened together at the back by a membrane, which is part of the wall of the gullet. These little rings are to keep the tube always open so that whether we are asleep or awake, air can go into the lungs. These rings and the whole of the windpipe are lined inside with a mucous membrane, and if this mucous membrane is put under a microscope, it is seen to be thickly grown over with fine little hairs, called "cilia," which are constantly moving upwards—their work is to sweep away all dust or particles of grit, and send them on up to the nose where they are got rid of.

The Larynx.—The Bronchi.—Air cells.—The Pleura.—There is still something else to remember in the windpipe, and that is the voice box, or larynx, which has chords stretched across it. It is by the air vibrating through these chords that we are able to speak. Now the windpipe is not very long, for directly it gets to the root of the

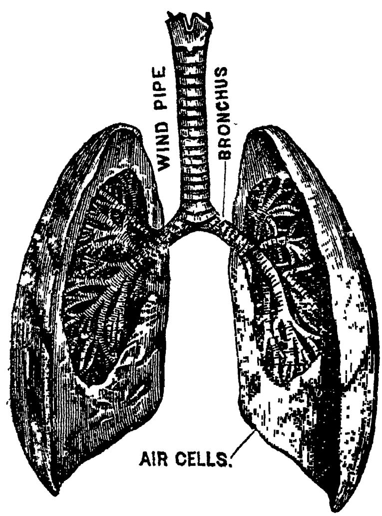


Fig. 4

neck it divides up into branches and sends one to each lung. Each branch, or bronchus, as it is called then divides into smaller branches, always getting finer and finer just like the arteries until at last they end in very, very fine little tubes, each of which has a bunch of tiny little bladders, called air cells at its tip. These air cells really make what is called the lung, and over their fine little walls run the minute capillaries carrying the blood which has to be cleansed by the fresh air. The lungs are very delicate organs, as can be imagined, so we find they are protected like the heart by a bag containing fluid. This bag goes all over the lungs, between them and the rib bones, and is called the Pleura.

Inspiration.—Rib muscles.—Now how does the air get down into all these little air cells? We know that the chest is like a closed box; the diaphragm, which separates the chest from the abdomen, is the floor, the neck is the top, and the ribs are the sides. Now the diaphragm is an arched muscle, and when that contracts the chest is made longer. Between the ribs also are oblique muscles, like crossed elastic bars, which pull the rib bones up, and when they contract they make the chest wider on all sides, that is, a vacuum or empty space is made inside the chest. Then, what happens? As the inside of the chest is thus enlarged, air is drawn in through the nose, down the windpipe and the bronchi, and by rushing into the air cells fills up the space the chest has just made for it.

Expiration.—But notice, directly after the air has gone down, the diaphragm and rib muscles all relax, the pressure of the outside air causes the chest to fall in or contract, the chest becomes smaller, and the little air sacs are squeezed down so that they drive the air out of the lungs again.

Pause.—Change in the blood in the Lungs.—Then there is a short pause, and then the breathing in, or inspiration, and the breathing out or expiration begin again. But although we feel how quickly the air goes in and comes out of our lungs, there is still time for that marvellous change to be made in the blood which the air touches. The blood, as we know, gets rid of all its impure carbonic acid gas and goes away red and clear. Now where does this carbonic acid go to? It goes into the air which we breathe out, and so leaves the body altogether. And the air which comes in fresh and pure goes out impure, that is, the blood has made an exchange with the air. It has given up the carbonic acid gas which it no longer requires, and taken in the pure gas oxygen which we shall afterwards learn more about.

Breathing purifies the blood.—At present the chief things we have to remember are, that in breathing we purify our blood, keep up the heat of our bodies, and get rid of carbonic acid gas and certain other waste substances.

Waste matters in expired air.—We cannot see these waste substances, it is true, any more than we can see the air around, but we get rid of them all the same, and if we breathe the same

air over and over again, as people sometimes do in their sleeping rooms, or any room that has the doors and windows shut, we breathe in poison which has really come from our own bodies.

The waste matters we get rid of by our lungs are three :—

Carbonic Acid Gas,
Watery Vapour,
Organic Matters.

Carbonic Acid gas.—The first, carbonic acid, is a gas that is produced when oxygen comes into contact with carbon. Carbon is a thing that we all know, though perhaps not by that name.

Carbon.—Animal Heat.—Charcoal is a form of carbon, and a diamond also, in fact a diamond is the purest kind of carbon. Carbon is a thing that is in almost all the tissues of our body, and in almost all our foods, so that it is being continually taken into the body and has to be continually got rid of. When carbon and oxygen come together, the process of burning, or oxidation, as it is called in chemistry, takes place, and carbonic acid gas is formed. When carbon and oxygen unite very rapidly, both light and heat are produced, as when a fire burns, but in our living bodies they unite more slowly and only heat is formed. We can now understand that it is by the oxygen we breathe in, mixing with the carbon in our blood, that the heat of our bodies, or what is called Animal Heat is produced.

In health the heat of the body is 98·4° Fahrenheit, and the air that we breathe out is 98·4° too.

When the heat of our blood gets higher than this, we have fever, and every degree higher it is, the more dangerous does it become. Both fever and bad headaches often come from breathing the same air over and over again.

Watery Vapour and Organic Matters.—The second, the watery vapour from our breath can only be seen when the weather is cold enough to condense it, or when by breathing on a glass or piece of polished silver a mist is seen to form on the surface. Six grains of this watery vapour are given off every minute by our lungs, which make about half a pint, or five *chittacks*, during 24 hours and it is this hot, impure watery vapour which is harmful in crowded and unventilated rooms, while it is the third, the foul organic matter which makes a room smell stuffy and close. It sticks to the walls, the ceilings, the *durries*, curtains and everything in a room, and can only be got rid of by keeping everything very clean.

It consists of decaying animal and vegetable matter containing, it is probable, germs of disease such as consumption.

CHAPTER V.

THE LIVER AND THE EXCRETORY ORGANS—FUNCTIONS OF THE LIVER—ITS STRUCTURE—THE PORTAL CIRCULATION—BILE—GLYCOGEN—EXCRETIONS BY THE LUNGS—THE SKIN AND ITS GLANDS—THE KIDNEYS—URETERS—BLADDER—CORPUSCLES OF THE KIDNEYS—EXCRETIONS BY THE KIDNEYS.

When we learnt how food was changed into blood, it was said that after it left the stomach a fluid called bile came into the duodenum from the liver.

The Liver.—Work of the Liver.—Now the liver, which is placed just underneath the Diaphragm, on the right side of the abdomen, is the largest organ in the body, and it is also one of the most important. It has not only to manufacture and pour out bile to aid the digestion of our food, but it has two or three other different kinds of work to perform as well. One of the chief of these is to prevent poisonous substances, which may form in the intestines during digestion, from passing straight into the blood, or in other words, to act as a kind of door-keeper, or porter to the circulation. Another is to form and store up Glycogen, or Liver starch which gives us some of our animal heat and muscular strength. And the last is to destroy the poisonous properties of peptones, formed

whilst digestion is going on, and to arrest any poisonous substances that have found their way into the blood.

Knowing now what important and varied work the liver is called upon to do every day, we shall not be astonished to find that it is not at all simply made, and that it has a special kind of circulation of the blood in it, which we do not find anywhere else in the body.

Structure of the Liver.—Circulation in the Liver.—The Portal Vein.—The Liver is called a mixed organ, because it not only takes substances out of the blood like a gland, but supplies it with others. If we examine it to see how it is able to do so many different kinds of work, we see that it is made up of masses called lobules and these lobules are made up of cells. Everywhere between these lobules and cells there is a net work of blood vessels, and the blood which feeds them comes from two sources. It comes from an artery which is a branch direct from the Aorta, and is called the liver artery, and it also comes from a vein called the Portal Vein, which brings all the blood from the stomach, spleen, pancreas and intestines. This vein is a very important one to remember.

1st.—Because it divides up into branches, and ends in capillaries like an artery.

2nd.—Because it takes all the blood that is formed after each meal in the stomach and intestines to the liver, before it can go into the general circulation.

If we notice the circulation in the liver still more closely, we shall see that the liver artery

and this portal vein enter the liver side by side; that they divide up between the lobules and cells of the liver still running side by side; and that they end in the *same set* of capillaries. Afterwards they run together, like all other capillaries, and form a large vein which, when it has left the liver, empties its blood into the great vein coming from all the lower parts of the body, which, as we know, goes into the right auricle of the heart.

Portal Circulation.—The circulation in the liver is called the Portal Circulation, and now we understand it, we see how it is that the liver is able to act as a door-keeper to the general circulation, and how it can destroy poisons which are formed whilst our food is digesting, before they get carried to the blood going direct to our heart, and from there all over our bodies.

Glycogen.—But the liver does more than take out these poisonous matters from the blood of the portal vein as it is flowing through its lobules and cells. It changes these poisonous matters, as well as any sugar there is in the food we have digested, into the liver-starch, called glycogen, which is apparently oxidised in the lungs thus producing heat and warms and nourishes our body, or is stored up for use at some other time.

Bile.—And besides this, it separates bile from this newly made blood. Bile we already know is a kind of very strong soap, or soda, which digests the fats in our food, and helps to prevent our food decaying in our bodies as it passes through the intestines.

Gall bladder.—The bile, after it is separated from the blood, goes into the bile duct, which leads to the duodenum ; but before it leaves the liver the duct has to pass the gall bladder which opens on to it, and if there is much bile going along the duct, some of it flows into the gall bladder and is, like the Glycogen, stored up for use at some other time.

Biliousness.—When too much is formed and stored every day, people get what is called "bilious," that is, the bile does not only go into the intestines, but it gets back into the blood, and then causes headache and sickness.

Over-eating or drinking, especially in hot climates, soon upsets the liver, but we cannot be surprised at this, now we know what a great deal of work the liver always has to do to keep us in health.

The Excretory Organs.—From the liver, which we have seen is a mixed organ, taking substances from and adding others to the blood, we now pass to the Excretory Organs, whose chief work it is to take away the waste substances from the blood. There are three that do this :—

(1) The Lungs. (2) The Skin. (3) The Kidneys.

The Lungs.—The lungs we already understand, and we know that they separate waste carbon from the blood in the form of carbonic acid gas. Carbon is contained in nearly all our food, and so is constantly being added to the body, and has continually to be got rid of when it has given the heat required from it. The lungs get rid of nearly $\frac{1}{4}$ of a *seer* of carbon

every 24 hours, and besides that, they get rid of about half a pint of water, and also a certain quantity of other waste matter. But, of course, it was never intended that the lungs should be able to get rid of all the waste of the body, and so we find the skin and the kidneys helping.

The Skin.—Sweat Glands.—Excretions from the skin.—If we could see a piece of skin under the microscope, we should find it full of wonderful little openings called pores, each of which leads down to a tiny twisted ball of fine tubing. This tubing is called a sweat gland, and millions and millions of them are embedded in the underneath layer of our skin, with millions of little capillaries twining round and about them. Now day and night, whilst the blood is running through the capillaries in the skin, these little sweat glands are busy separating all the waste carbonic acid, water, and foul organic matter that they can get from the blood, and carrying it away in their tubes or ducts to the surface of the skin. About nine *chittacks* are got rid of every day like this, without our knowing anything about it, so it is called "insensible perspiration," but when we walk, or run, or take any exercise, then these little sweat glands work so fast that we can actually feel or see the water on our skins, and we call that perspiration, or sweat.

Sebaceous Glands.—Hair Glands.—There are still some other glands in the skin. They are called sebaceous glands; and their work is to separate fat and oily matter from the blood, to keep the skin supple, and to nourish the little

hair glands close to them, which are also in the skin and from which our hair grows.

The Kidneys.—Ureters.—Bladder.—Now that we know that both in the lungs and the skin waste matters are got rid of as the blood is running through the capillaries, we shall not be surprised to find that the work in the kidneys is done in much the same way—but that as the waste matter to be got rid of is mostly water, a different kind of apparatus is needed. We each have two kidneys for the purpose. They are placed in the abdomen, one on each side of the spine about the waist, and when they have separated out the water or urine from the blood, they pour it into tubes called ureters, which carry it down to the bladder, a strong bag in which the urine goes on collecting until it is necessary to expel it.

Composition of the Kidney.—Now the kidney is built up of a number of tiny tubes, which begin in small bags or corpuscles in the large outer rim of the kidney, and end or open out into the beginning of the tube which leaves the kidney—the ureter—which is shaped like a funnel.

Corpuscles of the Kidneys.—These tiny tubes are like sweat glands, carrying off the water as it is separated from the blood; but they are much larger than sweat glands, as they have harder work to do, and they are different in another way. For instead of the capillaries twisting round the glands as in the skin, the capillaries in the kidney find their way right into the small bags or corpuscles—in fact as they divide up

from the artery they push the delicate lining of the end of the tubes inwards, thus forming the little bags in which they do their work.

Circulation in the Kidneys.—Excretions from the Kidneys.—Again, the capillaries when they leave the little corpuscles do not unite into veins which takė the blood away from the kidney at once, but they unite into veins which divide again into capillaries like the portal vein, and this second set of capillaries winds about outside all the length of the little tubes before they join into veins which leave the kidney. All the time the blood is running through the capillaries it is busy getting rid of water it no longer wants and other things such as urea and uric acid, both nitrogenous substances which would do a great deal of harm if not got rid of. This liquid waste matter, known as urine, 3 lbs. fluid daily, passes through the walls of the capillaries into the tubes which carry it safely away to the ureters and thus to the bladder from which we get rid of it as occasion requires.

Blood which leaves the kidneys is the purest in the body, having lost so much nitrogenous material.

CHAPTER VI.

THE NERVES AND SENSES—SYMPATHETIC SYSTEM —ORGANS IT CONTROLS—CEREBRO-SPINAL SYSTEM—THE BRAIN AND SPINAL CORD—MOTOR AND SENSORY NERVES—SPECIAL SENSES—TOUCH—TASTE—SMELL—HEARING AND THE EAR—SIGHT AND THE EYE.

Now we come to the question :—How are all these different organs kept working, and what is it that controls them, so that they work regularly and well, and balance each other ?

This is done by the nerves or nervous system.

Nerves.—Nerves are quite different to anything we have learnt about so far, for they are simply like soft white threads which are found in every part of us, and carry messages to and from the brain, like telegraph wires to and from a telegraph office.

The Sympathetic System.—Now there are different kinds of nerves for different kinds of messages. There are those which belong to what is called the Sympathetic System, whose work it is to see after our breathing, the circulation of our blood, the digestion of our food, and the regular working of all our organs.

The Cerebro-Spinal System.—And there are others which belong to what is called the Cerebro-Spinal System, that is, the Brain and Spinal Cord, whose work is of a higher kind. They

have to do with our voluntary muscles and with our senses, as well as all we say, or think, or feel or do.

Work of the Sympathetic Nerves.—Ganglia.—Now it is the nerves of the Sympathetic System that see to the regular working of all our different organs. These nerves consist of little centres called Ganglia (knots) which are found on each side of the spinal column giving out nerve fibres—to all the glands in our body and to all our involuntary muscles.

Control of the Involuntary Muscles.—For instance they carry a message to the salivary glands to tell them food is coming, and that they must pour out their saliva ; they tell the heart how much blood is to be pumped from it every time it contracts ; they tell the lungs and the muscles connected with our breathing when they should contract and when expand—in fact they see after everything that has to work night and day whether we are asleep or awake, and whether we are thinking about it or not.

Temperature of the body.—And one very important thing there is which these sympathetic nerves do, and which we must remember, that is, they control the circulation in the skin, and through the skin, the heat or temperature of the body. On a cold day when it is necessary to keep all the warmth within, they make the small vessels in the skin contract so that very little fluid or heat is lost from the body. Whereas on a hot day, as the body wants to get rid of its heat, the nerves cause the vessels in the skin to relax, so that perspiration runs out freely

and the superfluous heat escapes. It is for this reason that chills are so dangerous because if the skin gets chilled, the heat cannot escape, and so gets driven in when it is not required and may make us ill.

These sympathetic nerves, we see, act without any effort or will on our part, and so are very different from the higher kinds of nerves which are controlled by our will.

The Brain.—Motor and Sensory Nerves.—The seat of the will is in the brain, and these higher nerves come direct from the brain and spinal cord. We remember how we learnt that the brain was contained in a very strong box called the skull. The brain consists of a finely delicate material called nervous matter and has two main portions, the large brain which is the seat of intelligence, the emotions and the will; and the small brain which serves to regulate the movements of the body. And not only is the brain contained in a very strong case for safety but it is wonderfully protected within the bony case, first by a membrane lining the bone which is hard, tough and fibrous and next by a close sac of very fine membrane called the arachnoid membrane because it is as fine as a spider's web. This has fluid within it just like the pleura round the lungs or the peritoneum in the abdomen that keeps the brain soft and moist and also prevents jars and shocks. 4. There is also another very fine thin membrane which dips in and out of all the folds and parts of the brain and of the spinal cord, which is a continuation of the brain. This fine membrane carries a net-work of minute

blood vessels which supply the nerve matter with blood. The Spinal Cord which commences just where our head joins our neck is contained in the Spinal Column, which is another very very strong casing for this important nerve matter and although it has a separate name, it and the brain are quite joined together and the rounded brain tapers off into the narrower cord in such a way that it is difficult to say where the one begins and the other ends.

Our nerves which are really branches of nervous material running out from the brain and the spinal cord are everywhere all over us. Those from the brain pass through holes in the skull and seem to spread out very irregularly and those from the spinal cord run out in 4 pairs on each side between every two vertebræ, divide into branches and so are spread all over the body. They are everywhere like the blood vessels. Every part of the body with some few exceptions is crowded with nerves and blood vessels. The nerves all come from the brain or the spinal cord and the vessels from the heart, so that every part of the body is governed by two centres, the Heart and the Brain. These nerves are of two kinds, some are to carry messages from the brain, others to carry sensations to the brain. When we stretch out our hand to feel whether anything is hot or cold we use both kinds of these. First we use the nerves which carry the message from the brain to our muscles, that we wish to move our hand and arm in a particular direction to touch something; next when we have touched it, we use the other nerves to

carry the idea of what it feels like to the brain. The first are called "Motor" nerves, because they carry out the brain's orders with regard to all motions or movements—the others are called "Sensory" because they carry sensations to the brain.

Nerves from the Brain.—Spinal nerves.—These nerves, as we said, all come out from the brain or spinal cord—the nerves which go to our eyes, ears, nose and tongue, and which are sensory nerves, that is, they carry the sensation of all we see, hear, smell or taste, all come direct from the brain, and the nerves which move the muscles of our eyelids and eyeballs also come from the brain; but the nerves which move the big muscles of our arms and hands or legs all come from the spinal cord, that is, indirectly from the brain. Now we can understand why it is that when anyone hurts their spine by an accident, they can neither move, or feel below the part, for in such accidents the spinal cord is injured, and so can neither carry orders from the brain to the muscles which move the limbs or carry back sensations to it, just as when a telegraph wire is cut no messages can be sent out or come in through it.

There is not much more to remember about our motor nerves except that they enable us to move all our voluntary muscles, but there is a great deal more to learn about our sensory nerves. We have five senses as we know; Sight—Hearing—Smell—Taste and Touch.

Special Senses.—The idea of Light and of all we can see, reaches our brain through two nerves

which are hidden away in the eyes ;—the idea of Sound and all we can hear, through two nerves which are hidden away in the inner part of the ears ;—the idea of Smell through a pair of nerves embedded in the inner part of the nose ; —of Taste through a pair of nerves ending in the little papillæ or projections on the skin of the tongue ;—whilst Touch is not a sense which belongs to any one part but to the skin in all parts of our body.

Let us first understand what it is that makes us able to feel things, and then we shall more easily be able to understand our other senses.

Touch.—If we could see a piece of our skin under the microscope, we should see besides all the little sweat glands, oil glands, hair glands and capillaries, thousands of tiny little projections underneath the outer skin, and in each of these projections or papillæ the tiny ends of the sensory fibres of the spinal nerves—the sensory fibres being the nerves of touch embedded in the lower layer of the skin, so as to be out of harm's way.

If we think about it we know our nerves of touch cannot be in our outer skin, for if we rub or scratch the surface it gives us no pain—we merely feel the rub or scratch—but if we prick ourselves we feel a smart of pain because the little nerves themselves have been reached.

Now if we took the skin from several different parts of the body we should see many more of these sensory fibres in some parts, as in the tips of our fingers than in others.

Sensitiveness of the finger tips.—It is because there are so many in our finger tips that we can feel things better with our fingers than with any other part of our body—and this is the reason why blind people can be taught to read by distinguishing different shapes of raised letters with their fingers. In some blind people the sensitiveness of the finger-tips becomes so great that they can even tell different coloured materials.

Sensitiveness of other parts.—To show how much better we can feel with our finger-tips and therefore how many nerves there must be in them, we have only to take a pair of scissors and place them with their points about a tenth or twelfth of an inch apart on the tip of a finger. Any one will be able to tell there are two points; but place them half an inch apart on the cheek and they feel like one point, or place them even 2½ inches apart on the skin of the back and they still seem like one point only.

Taste.—Just as we have the sense of Touch through nerves ending in the little papillæ of the skin, so we have the sense of Taste through nerves ending in the papillæ of the Tongue. Any one can see these papillæ on their own tongue but the ends of the nerves going to them would have to be seen under a microscope. These nerve fibres for the tongue all come from two special nerves of Taste direct from the brain, and when we eat anything they tell the brain whether it is nice or what it tastes like.

Smell.—The sense of smell is very like both Taste and Touch, for the two nerves of smell

which come from the brain divide up into hundreds of little branches in the upper part of the nose and are embedded in the mucous membrane lining it. Smell is one of the most useful senses because it often warns us of a danger to health before our eyes have discovered it.

Hearing.—And now we have to learn about a more complicated sense, the sense of Hearing or how it is that sounds made in the air outside reach the brain.

We all know that we hear with our ears, and that there is an opening from our ears which goes right into the head. That much it is easy to see, but that does not tell us how we hear. We must know all about the ear inside our heads and how the nerve of hearing is reached as well.

Sound.—But first we must remember these facts about sound :—

(1) That Sound consists of pulses or waves in the air.

(2) That water carries sound much more quickly than air.

In our ears we find all that is necessary for collecting these waves of sound into one wave, and besides that we find the nerves of sound floating in water, so that, the different sounds we hear may reach the brain quickly.

The Outer Ear.—The outer ear we notice is all curled and twisted to collect sound and this leads to a tube or passage which also winds a little, and has a great many hairs and a good deal of wax in it to prevent insects and dust from getting in.

The Drum.—The Bones.—The Oval Window.—The Labyrinth.—The Rock.—Nerves of Hearing.—At the end of this passage is a fine, almost transparent membrane, or skin stretched on a bony rim like the parchment of a drum. This is called the drum of the ear, and behind this are three bones connected with tiny joints. The first is like a hammer, the second like an anvil and the third like a stirrup. The hammer bone is fastened to the drum, and the stirrup bone to another little skin further in, called the Oval Window, which covers the opening to a still more wonderful part of the ear. This inner ear is something like a wind instrument of music, all spirals or twists. One part of it is called the Labyrinth because of its twists and turns, and another is called the Shell because it is like a snail's shell,—and it is all protected by or rather cut out of the hardest bone in the body called the Rock. Inside these labyrinth and shell-like passage we find a liquid, like water, and floating in the water a little bag also filled with fluid. If this little bag is put under the microscope it is seen to be covered with what look like fine little threads. These threads are really nerves to carry sound, which go on joining together until they make one big nerve which we call the nerve of hearing. We have a nerve of hearing, for each ear of course, coming from each side of the brain.

How Sounds are carried to the Brain.—Now we have to see how all these different parts enable us to hear. The waves of sound are first collected by the outer ear and come in by the

passage until they strike the drum. Directly the drum moves, it pushes the three little bones inside. They tremble or vibrate one after each other and so knock against the little oval window which sets the liquid inside shaking; and when that shakes, all the little nerves covering the bag floating in it vibrate too, and their vibrations travel on through all the little nerves to the big nerve of hearing, and so to the brain. Then the brain has to listen and think what the sound means—whether it is music, or crying, laughing, or speaking, or the song of a bird or the neigh of a horse. It is very strange to think that sound has to pass through liquid to reach our nerves and the brain.

Hearing in the lower Animals.—Some of the lower animals only have a nerve and a little bag and watery fluid for their ears, and yet they can hear very well. So that a nerve and a bag of fluid which can be reached by the waves of sound are all that is needed to hear. Our hearing is more complicated because we are reasoning beings, and are intended for higher purposes than animals.

The Eyes.—Just as in the ear we find everything that is best fitted to carry the waves of sound to the brain, so in the eye we find everything that is necessary for bringing the rays of light to a point where the nerve of sight becomes affected by them, and conveys the sensation to the brain. And just as in the ear we found winding passages leading to a watery fluid so in the eye we find lenses like the lenses of a telescope, with watery fluid between them. This

is very wonderful, for it shows that rays of light as well as waves of sound travel through watery fluid before they reach the brain.

Position of the Eye.—Protection for the Eyes.—Now the first thing to notice about the eye is that it is lodged in a strong, deep, bony hollow resting on a bed of fat—that it has eyebrows above it to prevent sweat running down into the eyes—that it has eyelids above and below to wipe it constantly, and to close it in sleep, or when harm is near—that each eyelid has a row of eyelashes to protect the eye from dust or grit flying in from the air—that each eyeball has a fluid constantly moistening it, washing away all specks of grit and keeping it bright—and that there is a tiny hole in the inner corner of the lower eyelid, which is the opening to a little tube for carrying off this fluid when done with, down to the nose.

The Tear Gland.—This fluid is chiefly secreted by a large gland called the Tear gland placed above and to the outer side of the eyeball.

Tears.—Ordinarily, it runs off gradually down the little tube to the nose, but when we are sorry or hurt, so much fluid is poured out that it cannot all run down the tube, and so it overflows and makes tears.

Muscles of the Eyeballs.—If we look behind and round the eyeball we see in addition muscles to move the eyes in different directions, and besides that, the great nerve of sight piercing the two outer coats of the eye and entering the eyeball where it spreads out.

Now how does light reach this great nerve of sight?

The Eye a series of Lenses.—It reaches it through a series of lenses which collect the rays into a focus and throw a picture on to the back of the dark interior of the eyeball. A lens is any clear glass-like body, so shaped that rays of light passing through it are made to change their direction, and to make objects at a certain distance either larger or smaller. In a telescope we have several lenses so formed as to bring far away things near, and in a microscope we have a number of lenses so formed as to enlarge very tiny things. Now the eye is really a number of lenses similar to these.

The Cornea.—The Iris.—The Pupil.—The Crystalline Lens.—In the front standing out from the white of the eye we see a clear raised piece like a watch glass. This is called the Cornea, and is really the first lens of the Eye. Behind it is a flat piece, the Iris or curtain of the eye, with the black hole in the middle which we call the Pupil. The Iris is not a lens but is a coloured movable curtain, closing up slightly to shade the eye when the light is too strong, and enlarging the opening in the centre when there is but little light,—besides that it cuts off all rays of light coming sideways, which would otherwise confuse our sight. Behind the Iris again is another lens, which is called the Crystalline or Accommodating Lens. It is the most important of all because it enables us to see things far off or near. It is the only lens with a muscle attached to it—a little muscle which is inside

the eye and which contracts or expands the lens according as we want it rounder or flatter for seeing things distinctly at different distances.

In some of us the lenses of the eye are so arranged that the rays of light are focussed too far in front of the retina for pictures to be sharply defined—such are said to be short-sighted and have to wear concave glasses to overcome the defect—while again in others of us the rays may be focussed too far behind and then convex glasses will have to be worn—when the young suffer in this way they are said to be long-sighted, it is however, a defect that accompanies middle and old age.

Aqueous Humour.—Vitreous Humour.—The Retina.—In between the Crystalline Lens and the Cornea is a little fluid called the Aqueous Humour, and this again acts as a lens; whilst some thicker fluid called the Vitreous Humour behind the Crystalline Lens, which fills all the hollow of the eyeball, forms still another lens. All these lenses together collect the rays of light coming from all directions around us and thus throw a picture of whatever is before us, on the nerves of sight at the back of the eye. These nerves are a net work of tiny, tiny branches of the large nerve of sight coming from the brain, and they spread out to form a coat of the eye called the Retina. Behind the retina again is a coat of pigment or colouring matter which not only carries blood to the retina, but besides that does a useful work in absorbing superfluous light, which, if reflected back, would confuse our sight.

The Rods and Cones.—The retina is a wonderful little piece of our body to study, to see how marvellously and beautifully we are made. The rays of light, carrying the pictures we are looking at, after being focussed by the lenses, strike on the retina as we know, but it is through a layer of cells like fine mosaic work, called Rods and Cones, that they are borne along the nerve fibres to the brain.

The Optic Nerve.—Thus these nerve fibres are like all others of our sense nerves, because they are not directly sensitive to that which stimulates them. It is only through the layer of Rods and Cones that they are sensitive to light, just as it is through the outer layer of the skin that the nerves in the underneath skin are sensitive to touch.

Smallness of the Retina compared with all we can see.—Again, although the retina is such a small surface about half an inch across, or the size of a four-anna piece, yet it is on it, that miles and miles of landscape and sky and all things both small and great, are pictured and carried to the brain with the size and colour of each different thing accurately shown.

A truly wonderful little organ, the eye—with its lenses and nerves of sight—must be, when we think, how small it is compared with all we can see.

SECTION II.

HYGIENE.

CHAPTER I.

HYGIENE—CHOICE OF A HOUSE—SITUATION—JHEELS OR MARSH-LAND—GROUND WATER AND DAMP HOUSES—PRECAUTIONS IN MARSHY SITUATIONS—DRAINAGE—THE BLUE GUM TREE—FLOORS—WALLS—ROOFS—DRAINS.

Hygiene.—We have learnt a good deal about our bodies which have to be kept healthy, and now therefore we pass on to the study of our surroundings—our houses, the disposal of refuse matters—the air we breathe—the water we drink—the food we eat, and the personal habits which will help to keep us well and strong. The study of all this, that is, of all that has to do with health, is called Hygiene or Sanitation, and both words mean simply "Health," or the Laws of "Health."

The study of Hygiene has nothing to do with medicine—it will not teach us how to doctor ourselves, or cure diseases, but it will teach us how to prevent diseases, and how to preserve or take care of our health.

Our houses.—One of the first most important things for our health, if we look around us, is

the house we live in. Of course it is not every one who is fortunate enough to be able to choose the house or even the place they have to live in. We are sometimes obliged to live in places which we know are unhealthy, and in houses which are badly built. All the same it is very useful to know what a good house should be like, where it should be built, and how it can best be supplied with fresh air. If we know that, we can do a great deal to improve even an unhealthy house, whilst if we can choose at all in the matter, we shall know how to choose what is best for our health in every way.

A house, if we think about it, is a very important thing. It is our shelter against heat and cold and rain, and a great part of our time is spent in it, either sleeping, eating, or working.

Air and Water.—We ought therefore to be careful that we get as good a house as we can, that we keep it clean and dry and fresh and sweet-smelling—and that we have fresh air and good water around us. Two of the worst enemies to our health are foul air and foul water ; and even if we cannot always be sure we have good water, still we can do a great deal towards helping to keep the water around us good and fit to drink, whilst as regards fresh air, it just depends entirely upon ourselves and the people we live with. There is plenty of fresh air and pure water around us everywhere, and it is our own fault if we do not get them.

There is a great deal, however, to study about both, so we will leave them to another chapter whilst we see what a good house should be.

Situation.—First we must remember it must be in a good site or situation. A good site is one that is dry, or can be easily drained, that is, where water will not lodge. A house on flat ground, or on a terrace cut in a hill-side or slope, is in a good situation, but a house in a hollow or low-lying marshy place is in a bad situation. There is no worse place for a house than marshy or badly drained ground.

Jheels.—We call any place a marsh or *jheel* where water cannot get away naturally because of a stiff, closely-bound soil underneath which will not allow the water to pass through. A *jheel* may be made by the water overflowing from a river, or by the flow of a river being blocked by the solid matters it brings down with it—but the result is always the same—stagnant water, a great deal of vegetation, and a pestilential smell in the air, owing to the heat and the decaying matters in the stagnant water. Some of the worst diseases known have started from such places.

Damp houses.—Ground water.—Wells.—But it is not only houses in marshy places that are damp—a house which is too near a tank, or the bank of a river, is in a bad situation, just the same as a house which is built in a place where the *ground water* is very near the surface. Ground water comes from that great underground sea or lake which exists everywhere beneath the ground, but at different depths in different places. This is the water which we find in wells. In some places a well has to be cut a great depth before water is found, and in

others only a few feet. A house or village should never be built anywhere if the ground water is nearer than five feet to the surface. But even five feet is too near for health, and a place is safer to live in, the lower the ground water is. In India, and in all countries where wells are dug, it is always easy to tell how far off the ground water is, by finding out how deep the wells are in any place.

Supposing, however, some of us cannot help living where the ground water is too high, or near a marsh or *jheel*.

Supposing a forest has to be cut down, or a railway made through a bad marshy country—what are we to do?

Precautions in marshy places.—We should take these precautions. Have our house or tent on the highest piece of ground we can get.

Never sleep on the ground because people sleeping on the ground are always more likely to get fever or ague than those who sleep off the ground even if it is only in a hammock. Sleep under mosquito nets and have all doors and windows of wire gauze which are shut before sunset and opened after sunrise. Never open the windows or doors facing the marsh if the wind is blowing over it, but open the windows and doors on the further side of the house or tent.

Eat well cooked wholesome food and never drink water from the marsh, if it can be helped. If there is no other water to be had, boil the marsh water.

Make the best arrangements possible for carrying off the ordinary water and flood water

in the rains, both close to the house and as far around as can be managed—and fill up all hollow places where water can lodge.

Next—if the stay in a marshy place is to be a long one, plant trees and shrubs between the house and the *jheel*. Some plants and trees are well known for their power to dry and clean the soil, and these are the proper ones to plant. They tend to break flights of mosquitoes and to keep the soil dry and so prevent the breeding of mosquitoes.

The Blue Gum Tree.—Among them the Blue Gum Tree of Australia, known as the Eucalyptus, is very valuable, and it has already been planted in some parts of India with great success—another which is very easy to grow is the ordinary sunflower.

A good site.—A good site for a house is, as we have learned, one that is dry—but it is also one where fresh air can blow freely round it, and where high trees on perhaps two sides of it can protect it a little from the burning heat of the sun's rays. It is also one which is not too near a stable, or place where any refuse is thrown. In bazaars or villages it is a good thing to have the houses wide apart, so as to get as much open space as possible in order that light and fresh air can come into every house.

Building materials.—A house to be thoroughly healthy must not only be in a good situation but it must be well built. It must be built so as to keep both heat and damp out, and so as to let plenty of fresh air in. In this country, houses are built chiefly of stone—or bricks,

either *pucca* (fire-burnt) or *kachcha* (sun-burnt) —or mud. Of course stone or *pucca* brick is the best, but any house can be made healthy to live in if four things are remembered, *viz.* :—

(1) *Floors.*—To make and keep the floor dry—first to have a plinth, that is, to raise the floor above the level of the surrounding ground —secondly, to have where possible a layer of asphalte or chunam. The best floors are those of concrete with a cemented surface, or of gravel mixed with tar. If there are wooden floors, there should be a space between the concrete and floor, well ventilated, but so arranged that vermin cannot get between. It is a very good thing to have an open space below the floor where the air can circulate, as it keeps a house both dry and sweet-smelling.

(2) *Walls.*—To see that no wet can get in through the walls, and that the foundations are carried down four or more feet. Where the walls are of sun-dried (*kachcha*) bricks the clay covering them should be carefully renewed from time to time. These walls tend to give harbourage to rats and are therefore a danger and the bricks are like sponges for sucking up moisture, so that if they are not kept well covered walls made of them become very damp. Tar is an excellent thing to cover such walls with inside. It can be washed down now and again and does not want constant renewing. An impervious stratum of slate or tarred felt should be placed in the wall just above ground level to keep damp from rising in the walls and also to keep rats out. Walls are better if "*pucca.*"

(3) *Roofs.*—To see that the roof is a good one to keep the house cool, and that it has plenty of good drains to take the rain away. A thatched sloping roof with a deep thatch over the verandah will keep a house the coolest. A slate roof makes a house hot—but a corrugated iron one, such as one sometimes meets with in India, and which is admired because it is "European" is excessively hot and unsuitable. If corrugated iron has been bought, and the best has to be made of a bad job, a good plan is to make an inner roof of wood and fill in the space between that and the corrugated iron with sawdust or some other non-conducting material.

(4) *Drains.*—To see that the drains, both from the roof and round the house, are good and take off all the water right away from either one's own or one's neighbour's house. Drains should always be made of brick or some hard material, so that the water cannot soak through into the ground, and should always slope downwards so that the water runs away quickly. They must also always be kept clean and open. If any earth slips into them it must be dug out.

Dirty water from the house or the cook-house must never be thrown on to the ground, or into a drain near a house, but should be put into a *ghurra* or old kerosine oil tin and taken away by the *mihtar* and buried. If water is thrown down close to a house, it will soak into the ground and make all the house damp, as water soaks up into the walls as well as down into the ground. Neither bath nor rain water must be

allowed to collect in *pucca* catch-pits, holes in the ground, tubs or any kind of receptacles near houses as they would form breeding places for mosquitoes.

Tanks, wells and anything holding water must be kept covered to prevent mosquitoes entering, and no hollows or depressions in the ground should be tolerated near dwellings.

CHAPTER II.

SANITATION AND CLEANLINESS—DISPOSAL OF REFUSE—CONSERVANCY—VENTILATION—LATRINES—REFUSE TRENCHES—HOUSE REFUSE—CLEANLINESS OF HOUSE AND ROOMS—LEEPING—COW DUNG—DISPOSAL OF THE DEAD.

Sanitation and Cleanliness.—We said in the last chapter that we should always keep a house clean and dry, fresh and sweet-smelling and we learned how to keep it dry by having good drains, good roofs, floors and walls. We have now to learn how to keep it clean inside and out, and always to have it fresh and sweet-smelling.

Disposal of refuse.—This can only be done by having a good system for getting rid of all refuse or waste things—of everything that has to be thrown away every day, that is, everything that smells, or that would smell if left to decay, and provide breeding places for flies, the carriers of enteric, dysentery, cholera or other dirt diseases.

Neglect of the Laws of Health.—If refuse is not got rid of, it gets into the water we drink, or the air we breathe, and we may get typhoid fever, or cholera, or diarrhœa, or dysentery or diphtheria, or inflammation of the eyes, or if we do not grow actually ill we become weak and soon get tired over our work without knowing why we should feel so. Only a very few people

who live in clean, well-kept houses ever suffer from them; and when they catch them it is because other people have been dirty, or have not known what harm they might do by being careless about dirt and waste matters. When we know how many people have these diseases, and that they are all caused by not taking proper care in getting rid of refuse and dirt, we ought for the sake of our own health as well as for that of others, to do all in our power to see that the system and arrangements in our own house, or in our own village or town are the best that can be.

Now these waste matters which are dangerous to health, if not properly got rid of, are of several kinds—some are from our own bodies, whilst some are from our houses and cook-houses—and like everything else in the world around us they are solid, liquid or gaseous (like gas).

Conservancy.—The getting rid of the solid and liquid waste matters is called conservancy.

Ventilation.—The getting rid of the gas-like waste matters is called Ventilation.

Now, if we remember all that we learned in the Physiology lessons, we shall know that three kinds of waste matters, or excreta as they should properly be called, are thrown off from our bodies every day. Our bowels carry away and get rid of the solid excreta—our kidneys with a little assistance from our skins and our lungs get rid of the liquid waste matters, and our lungs get rid of the gas-like waste matters.

The question is, what should be done with all these waste matters which are no longer of any

use to ourselves, and which unfortunately give rise to bad smells and disease if left in or near our houses.

Balance in Nature.—The answer is they should be returned to the earth. What is poison to us is food to the earth, and what is no longer of use to us is of use to the earth. This is a very wonderful thing, and it is a truth which is the same all through nature. We shall see a little later on, how the waste gas we breathe out is the very gas that plants require to breathe to keep them alive, and how the gas which we breathe in and which gives us life and health is the same gas which is breathed out by the plants.

Waste.—It is this balance which keeps all nature fresh and sweet-smelling, and prevents there being such a thing as *waste* in the world. The things we call waste matters are waste to us, because *we* no longer can use them, but they are not waste if properly got rid of, that is, if they are returned to the earth where science teaches us they will be useful.

Bad Conservancy.—There are of course both good and bad ways of returning refuse to the earth. The bad ways unfortunately are generally the easiest, and save trouble to the people themselves; but one must remember, though they may save trouble at the time, they may give a lot of trouble and pain in the end by causing sickness and death. It is a bad way of returning refuse to the earth, for people to get rid of either the solid or liquid excreta from their bodies by the side of a road, or a hedge or

on the bank of a river or tank, or on the top of a house. If many people do this it causes a bad, unhealthy smell all round, and when the wind blows, the dry, solid matter is sometimes carried long distances perhaps into the water we drink, but certainly into the air we breathe, and thus may lead to disease.

Latrines.—Glazed gumlas.—The only safe and decent plan is to use latrines, that is places which are, or might be built, either in every compound to a house, or in several convenient places near a town, a village or a bazaar. A latrine should be built of *pucca* brick or iron and have a sloping, overlapping roof raised on supports about a foot above the top of the walls so that there is a large open space on all sides at the top where the bad air can escape. Small openings, if made on a level with the plinth, will give quite enough space for fresh air to enter by, and with these openings the smell inside can never become very bad even in a public latrine. Glazed *gumlas* are the best to receive the excreta because neither the liquid nor solid matter can soak into a glazed surface.

Dry earth.—A big box or tin of dry earth should also be placed in each latrine, and every body using the place should be asked to sprinkle some dry earth over the contents of the *gumla* before leaving.

Refuse trenches.—Dry earth disinfects such matters and prevents a smell which otherwise would last until the sweeper came to empty the *gumlas*. The *gumlas* should be taken away at least once or twice every day, and emptied

into a shallow trench of one foot broad by one foot deep, dug on land that will be cultivated.

Where there are no latrines, every headman of a village, or every owner of a house, should see that trenches for the same purpose are dug some little distance from where any one is living. Along the side of a hedge, or near the shelter of some trees, is a good place, because it can be made private, and each trench should be a foot deep and a foot broad. A little dry earth can then be sprinkled each time after it is used, and the whole covered in with dry earth when it is nearly full.

Rich crops.—It must be remembered that all excreta, whether from man or from animals, if given back to the earth in the way described, makes the earth give richer crops, and therefore gives man more food as well as better health. Sugar-cane and Indian corn give especially rich crops when planted on such ground.

Wet system.—In towns and cantonments instead of the dry earth system, the wet method of disinfecting excreta is by many doctors considered the best. This may be adapted in the home by having bottles or jars of disinfectant placed by the side of the commodes or *gumlas* and a little poured on to the solid excreta when required. The best disinfectant is Phenyle 1 in 500, or roughly a teaspoonful to a pint.

Minor refuse.—In the same way all the refuse from our houses or cook-houses should be got rid of by returning it to the earth. All dirty water, all mango or plantain skins, all scraps of vegetables, the skins of potatoes, all scraps

of meat or old bones, all sweepings from the house, or the compound, in fact everything that has to be thrown away from our houses every day, should be thrown into a *ghurra* or an old oil tin by the side of the house, and the *ghurra* or tin should be taken away and emptied once or twice every day into the same trench as the excreta or burnt.

Trenches.—All these trenches should be dug some distance from the house or village and should never be more than a foot broad and a foot deep. A large deep pit dug near a house is very bad, the smell from the refuse will come into the house. Wherever there is a bad smell, remember there may be a danger to health. A bad smell in or near a house, shows there is something wrong in the way we get rid of refuse, just the same as a pain in our bodies shows there is something wrong with our health.

Cleanliness of house.—So far we have only learnt how to get rid of the worst kinds of refuse, but if our home is to be thoroughly clean and sweet-smelling we must learn how to be clean in little matters as well as great. Every day each room should be well swept, and everything in it dusted with a *jharan*.

And not only each living room but the cook-house and the *botal-khana* must be kept quite clean also. *Degchies* and milk pans and everything to do with food should be cleaned with boiling water and scrubbed so clean that a white pocket handkerchief will not show a mark from them. Cold water is no good, as it will not take grease away. All shelves or *doolies*,

that meat, food or dishes are kept in, should also be thoroughly dusted every day.

Rooms.—Once every week again, every room should have an extra cleaning—*durries* and mats should be shaken and put out in the sun—all *phulkaries*, curtains and hangings should be well shaken, or beaten with a soft feather brush, and all the windows cleaned.

Leeping.—Where there are only mud walls and floors these should be fresh coated with clay water now and again, but both walls and floors must always be scraped quite clean before either whitewashing or leeping and leeping should not be done with the same dirty rag and pot daily.

They must be scraped clean first, because no amount of whitewash will take away the dirt underneath it, any more than clean clothes will take away the dirt off one's body. Scraping walls and floors before whitewashing or leeping is like having a good bath with soap and hot water before putting on clean things.

Cow-dung.—It is not a good thing to do this leeping as it is called, too often, especially in damp weather as it makes a house damp. And it is a very bad thing to mix it with cow-dung. It is no doubt often teeming with tubercle bacilli and fleas collect in the cracks formed in it, in the floors. Cow-dung is decaying matter and does not make a house cleaner or sweeter. Still it is a thing that natives of India believe is sacred, and so they think they cannot have too much of it about them. They make it into cakes to use as fuel, and plaster it all over the walls of their houses and villages whilst drying.

This is a bad thing for two or three reasons. It attracts rats and the smell from it makes the air unhealthy all round,—whilst burning it instead of letting it return to the earth as all waste matters should, makes the earth poorer, and so less good grain grows than where the cow-dung is dug into the earth.

Disposal of the Dead.—There is still one more thing to remember, if we wish to have all our surroundings in life as healthy and clean as possible, and that is how best to dispose of dead bodies whether they are of men or animals. In a hot country like India it is very dangerous to leave any dead body long without disposing of it. Directly anybody or anything is dead, whether it is a man or animal or a plant, decay begins to set in, and when anything decays it gives off a great deal of poisoned gas and poisoned matters to the air, water and earth.

Burning.—Burying.—Burning a dead body is really the best way of all to prevent these poisoned matters mixing with the air we breathe, or the water we drink, and thus harming those who are still alive,—but all people do not like to burn their dead, they prefer to bury them. If they are properly buried in a deep grave, at least five or six feet under ground with plenty of earth over them, this will not hurt living people, unless the grave is made on the bank of a river or near a well—or too near a house, or on ground where water will drain through into a well or river.

Dangers from dead bodies.—But neither burning or burying are properly done in many places.

Very often a body is burnt a little way from a house, and before it has all crumbled to ashes, the remains are thrown into a river or stream. Now until a body has all been burnt to ashes there is always decaying matter left which will breed poisonous germs directly the burning stops—so that it is very dangerous to health to throw half-burnt bodies into any kind of water.

But it is still more dangerous to throw a dead body into a river or canal without taking the trouble to burn it. The water soon helps it to decay, it is true; but whilst it is decaying, a great many people may get poisoned, or ill, in other ways, from drinking the water from that place.

Dead animals.—And it is just as dangerous to health to leave dead animals unburied, or to throw their dead bodies into rivers or streams. If they are left unburied vultures or other animals may come and pick the decaying flesh off their bones; but this may not always happen, and in fact often does not happen, until the dead body has poisoned all the earth and water around, and the vultures know by the smell that a dead body is there.

CHAPTER III.

AIR AND VENTILATION—COMPOSITION OF AIR—HOW AIR IS CHANGED BY BREATHING—CLOSE ROOMS—VENTILATION IN SICK ROOMS—BREATHING OF ANIMALS—LAMPS, CANDLES, ETC.—VENTILATION OF HOUSES.

Gaseous excreta.—In the last chapter we learnt about proper Conservancy, that is to say, how to get rid of two of the excreta from our bodies—the solid and the liquid—but we did not learn anything about Ventilation, or the way to get rid of the gas-like waste matters.

Dirty water.—Dirty air.—The gas-like waste matters are all thrown up into the air we breathe and perhaps because we cannot see them we think nothing about them, and do not take much trouble about getting rid of them. When we know a little more about the air we breathe, however, we shall all no doubt think it quite as dirty to sit in a shut up room, breathing into our lungs all the waste matters, that have emanated from other people, as we should to wash our faces or hands before eating, in a tub of water in which eight or ten people had been washing all the dirt off their bodies. In the case of water we can see when it is not clean, and we need not use it unless we like—but in the case of air, we cannot see, we can only smell that it is dirty and by the time we have smelt

it we have probably breathed a great deal of injurious matter into our lungs. Unpleasant odours are mostly due to emanations from uncleanly people.

Now what is this air which is so important to us made of, and how does our breathing affect it?

Composition of air.—Air is a mixture of gases, and when pure is made up chiefly of two gases :—

Oxygen	...	about 21 parts	in 100.
Nitrogen	...	,, 79 ,,	

These two gases are really a little less than this because there are small quantities of the following substances :—

Carbonic acid gas, 4 parts, in 10,000, or very, very little.

Watery vapour—varying with the temperature.

Oxygen.—(1) Oxygen, the first named, is the most important to us and to all animals. Nothing can live without it. Fire cannot burn without it, nor can the heat of our bodies be kept up without it. It is this gas, as we learnt in the first lessons on breathing and the circulation of our blood, which makes our blood bright red and gives us strength and energy to work. It has no colour, or taste or smell itself, and yet it is a very strong gas—too strong to be breathed alone.

Nitrogen.—(2) Nitrogen is the gas that dilutes oxygen and is necessary to weaken the strength of the oxygen in the air, just as water is mixed with drugs, when they are too strong to be drunk alone.

Carbonic Acid Gas.—(3) Carbonic Acid is the gas that is produced when oxygen comes into contact with carbon. It is the gas, we remember, which comes out of our lungs every time we breathe, and it is formed, we know by the oxygen in the fresh air we have taken in, uniting with the carbon in our blood. This gas also forms wherever a fire or a lamp or candle burns.

There is very little as we saw in pure air, but in any place where many people are breathing, or many lights are burning, a great deal of it is formed, and it then becomes one of the gaseous waste matters, which we know must be got rid of by ventilation.

Watery vapour.—Moisture.— (4) *Watery Vapour*, or moisture, the fourth substance in the air, is not a thing we can always see; we only see it when the temperature gets cool enough to make it show; yet all the water around us is constantly giving off vapour into the air. If we put some water in a saucer out of doors we see how it dries up or goes away—that is, it goes into the air around although we cannot see it. Moisture is, like all the other things in the air, absolutely necessary for life. Neither plants nor animals could live in a perfectly dry air as all the moisture in them would soon be drawn out by the thirsty air around. The amount of watery vapour varies very much in the air, when there is much we call the air "moist," when there is very little we call the air "dry." Heightened temperature and a large amount of watery vapour are a big factor in

producing loss of health. Both these tend to an increased output of foul smelling, volatile products from the bodies of occupants in rooms and houses.

Organic matters.—(5) *Organic and suspended matters* are small solid particles of such things as fine sand, dried mud, iron, dust, charcoal, tiny pieces of wood, of insects or spider's webs, of hairs, of seeds, of plants, etc. There are always quantities of these floating about in the air but they are so tiny that we cannot see them with our naked eye except in a sunbeam or strong light. We can see them very well, however, under a microscope, and see what kind of thing each tiny particle is. Many of these minute things in the air do us no harm at all, but others which are alike or decaying particles of organic matter are very dangerous to us.

Effect of breathing upon air.—Now we have learnt what good air is made up of, we have to learn how we alter it by our breathing. We know that when we breathe we always take oxygen out of the air and give back carbonic acid, and it is necessary to remember how much oxygen we use up in this way. With each breath we take we use up about 4 per cent. of the oxygen of the air that goes to our lungs, and we increase the carbonic acid in the air to the extent of 3·5 or 4 per cent. The nitrogen remains unchanged and the temperature of the expired air is raised to that of the blood, about 98·4° F. Expired air also contains 5 per cent. of aqueous vapour and a larger proportion of putrefactive

organic matters than the air inspired. If we constantly inhale air fouled by human beings we get a lower state of health and are more liable to be attacked by disease, lassitude, anæmia, consumption and dyspepsia. That sounds a great deal ; but when we think that the whole of our blood comes in contact with the air we breathe once every minute, or sixty times every hour, we can better realise how much oxygen we must always be taking out of the air, and how many waste substances we are always giving off into it.

Closed rooms.—Yet what do we see people continually doing ? They shut up all the windows and doors in their rooms, they stop up every little hole or corner where the fresh air can come in, and then they go to sleep all crowded together, often with their head and face smothered up in a blanket. Very often such people wake up with a bad headache—which has simply come from breathing the air they themselves have poisoned.

Or again, they light a fire and cook their food with the doors all shut up in the cold weather, and we know that the temperature and humidity of the air are relatively increased much more by lights and fires than by human beings. Women and children, who spend most of their time in-doors, suffer very much from breathing bad air in this country, and they not only suffer when they are in-doors, but when they go out travelling they are still no better off.

Travelling in doolies.—High born native ladies and all *purdah* women are shut up in *doolies* when

travelling—and as every one knows they are often ill for days after a long journey. It is a very cruel custom to shut anyone up like this, but perhaps when people understand the laws of health and know that these poor ladies are ill because their blood has been poisoned by the air they have breathed over and over again, their relatives may let them have the necessary fresh air both when travelling and when at home.

Fresh air required.—We each require a great deal of fresh air every hour if we are to keep well—the exact quantity is 3,000 cubic feet every hour, so the smaller the space and the greater the number of people in it the more frequently it must be changed. For instance one person in a room of 1,000 cubic feet would require the air changed three times in the hour, and if there were more people or a smaller room, it would naturally have to be changed more often. This is done by ventilation which we shall learn about later.

Fresh air in sickness.—Now we understand how even when we are well we are always wanting a fresh supply of air as our breathing is constantly changing the air around us, we can believe that in sickness it is doubly necessary to us. During ill-health the organic matter and gases given off from the body increase, micro-organisms abound; we become a danger not only to ourselves by self-poisoning but to others also. The air in a sick room is generally quite still; it becomes moreover warmer and more moist than the outside air, and, therefore the

dangers are greater especially as regards consumption of the lungs.

Nature's protection.—Fortunately there is seldom anything in the air out of doors to do us harm, because nature is constantly protecting us by mixing all poisonous matter with pure air. The chief dangers out of doors come either from bad conservancy, or from not getting rid of other refuse properly.

Trades which make the air impure.—Butchers ought not to be allowed to kill animals and dispose of the blood and refuse as they please, nor should other people, such as tanners and dyers, who make the air impure and foul the ground by the nature of their work, be allowed to carry on their trades in the public streets.

But after all, as we said, our worst dangers are in-doors, and those we can prevent.

Dangers in-doors.—The peculiar little scales which cover our skin, and which we can see in the scurf of the head, or when the hands get rough or chapped, are constantly floating off into the air around us; and in a sick room there are not only these but there are pus cells, *i.e.*, small circular particles which come from the pus, or matter in wounds or sore places—there are particles or micro-organisms not given off in ordinary breathing but in coughing, sneezing, loud talking, etc., when microbes present on the mucous membrane of the air passages are forced into the air. The germs of influenza, diphtheria, tubercle, etc., are thus spread and if breathed in they stick to the air passages and are absorbed by the tonsils and palate, although they may

not actually reach the lungs. And they are not only horrible to think of, but they may, and very often, do cause diseases.

Pus cells from sores may cause inflammation of the eyes, or a dangerous inflammation of the skin called erysipelas, or some kind of blood poisoning.

The particles from the spit from lung diseases may give healthy people who breathe them in, the same diseases—and the skin scales from people ill with small-pox, scarlet fever, measles or skin disease, may convey to other people these illnesses.

Diffusion of air.—But remember that unless we shut up our rooms, and so prevent fresh air coming in, nature is always trying to help us to get rid of the poison by diffusing it, or spreading it over a larger space, in other words diluting it with fresh, cool and drier air. Air is always moving and always helping us in this way, and the way we have to help Nature in return is by "ventilating," that is, giving plenty of room for the fresh, cool and dry air to come into our houses.

Breathing of animals.—But before we learn how we can ventilate our houses properly, we must know that it is not only ourselves who use up the oxygen of the air. All animals, cows, goats, sheep, dogs and horses breathe in the same way that we do, and require as much fresh air.

They ought never to be allowed to live in a house, or even in the downstairs part of a house, where people are living above, for not only do

they make the air impure by their breathing, but they make it still more poisonous by all the solid and liquid excreta from their bodies dropping on the floor, and they are the means of introducing vermin and so plague and other diseases.

Lamps, candles, etc.—And besides animals, everything that burns in a room—all lamps, candles, or charcoal, or wood fires—take the oxygen out of the air and give carbonic acid gas back just as we do, only to a much greater extent. Nothing we learnt, can burn without oxygen—it is only when oxygen and carbon come together that things burn, and then we know carbonic acid gas is formed. Coal-gas, which is fortunately not very common in this country, does the most harm when it is alight, as each jet gives as much carbonic acid to the air as four people—that is, 12,000 cubic feet per hour. One good oil lamp or two hard candles produce as much carbonic acid and use up as much oxygen as one person. Softer candles, which melt quickly and make a disagreeable smell, furnish more carbonic acid to the air than hard candles, because they throw off more soot or carbon into it. When we are thinking how much fresh air is needed in a room for each person, we must not forget to reckon each lamp or candle. Nor must we forget that it is a very bad thing to burn a fire in a room where there is no opening or chimney for the foul air and smoke to escape by. Though carbonic acid if in great excess produces headache we can put up with quite a large amount of it, provided the air does not

get much hotter or more moist. Charcoal in an open *ghurra* or pan is the very worst kind of fire, because a most poisonous gas is formed when charcoal burns—and many people have been killed by going to sleep in a closed room with charcoal burning. The gas given off from charcoal is not carbonic acid but carbonic oxide.

Ventilation.—This brings us to the best way to ventilate rooms. Many rooms have no proper ventilators, but all have windows or doors, and if we are not rich enough to put in ventilators, we can still manage to keep the air of a room fresh by always having one window or the door open day and night, *all* the time we are sitting or asleep in it. Then when we go out we can get perfectly fresh air into all parts of a room by opening the windows and doors on all sides and letting the wind blow through. If there is no wind, and not much movement in the air, it is a good plan to flap a door to and fro so as to make a draught and move the air about in a room. But we must always be careful the air comes from outside and not from another room. A door which only opens into another room which is shut up, is no ventilation at all.

Day and night ventilation.—We said that a door or window in every room ought to be open day and night—and this is very necessary for everyone is much longer in the same room by night than by day. It is remarkable too that we breathe out much more carbonic acid gas by day than by night, but on the other hand we absorb *twice as much* oxygen at night as by day. During sleep in fact we should be laying in our

store of oxygen for the next day so that we must have fresh air quite as much by night as by day. Some people think night air is bad because it is cold, but cold air does no harm if we are warmly covered, whilst the same air breathed over and over again does a great deal of harm.

Hot and cold air.—Besides windows and doors and fire-places which all help to let in fresh air, we ought, if possible, to have ventilators or openings both low down and high up in every room. Hot air is always lighter than cold air, and air is always moving because the hot air is constantly chasing the cold air, rushing up as it were, so as to make it all one temperature. Now the air we breathe out is always 98·4°, that is generally, or except in the very hottest weather, hotter than the air outside, and therefore it is lighter. This air we breathe out then rises up in a room, and the cold air sinks to the bottom, so when we want to ventilate a room we have to make openings near the floor for the fresh air to come in by, and openings near the ceiling for the hot, foul air to go out by. These can be made in different ways—either by openings in the windows, the floors, or the walls.

Ventilators in windows.—In windows either slits may be made in the panes of glass—or the "panes may be louvred," that is strips of glass may be placed lying one over the other and fixed on to a frame, which can be opened or shut; or, again, whole panes of glass may be taken out and replaced by wire gauze.

Ventilators in floors.—In floors, or rather in a line with the floor, openings may be made by

taking out one or two bricks, fixing a grating on the outside and having a tube or funnel running upwards about four or five feet inside the room. This tube is a good plan because no draught comes. But if there is only an opening in the wall the air blows straight in, and makes a draught in cold weather.

Ventilators in walls.—One of the best forms of ventilation is by lifting up the ridge of the roof.

Another is by leaving a space between the roof and the wall. But if neither of these can be managed, openings can be made near the ceiling by taking out bricks as before explained, but no tube is necessary.

If in cold weather the air blows down upon people sitting in a room it is a good thing to have a board sloping out and up, and closed at the sides. The cold air then goes up first and falls gradually, getting warmer as it comes lower down into the room.

Ventilation, we must remember, is letting in fresh air continuously and without draughts, so if there is ever a draught from a ventilator it shows it is not well arranged or is too small. A large window or door fully opened will often not produce a draught when air coming in through crevices will.

How to have fresh air always.—A good way to know whether a room is properly ventilated or not, is to go into it from the fresh air out of doors. If there is a close, stuffy smell, it shows the air is not fresh enough, for good air has no smell. Generally speaking we shall be sure to have fresh air in our houses if we carry out

all that has already been advised, and if, in addition, we are careful as regards a few other things.

(1) That verandahs should not be blocked up as they not only prevent fresh air coming into a house, but prevent the walls drying in damp weather.

(2) That no room or house should be overcrowded either by people, by animals, or by furniture.

(3) That openings for fresh air should not be stuffed up even in cold weather.

(4) That dark rooms are unhealthy and that the more light there is in a room the better the air will be.

(5) That the one main thing we have to avoid is breathing *used* air, whether it has been used by men, by cattle, by any animals or by lights.

Lastly, we must remember there is no excuse for not having fresh air in our houses, and that if we have sufficient cubic space for each person and that if facilities are afforded for the entrance and exit of air, the air, though perhaps more impure than external air, will not produce injury to health. There is plenty of fresh air around us, and nature is always keeping the balance even.

Breathing of Plants.—The carbonic acid we breathe out is taken up by all plants and vegetables—they separate the carbon from the oxygen and return the oxygen to the air. In this way they are constantly manufacturing what we want and we are as constantly manufacturing what they want.

CHAPTER IV.

WATER—COMPOSITION OF WATER—WATER IN THE HUMAN BODY—SOURCES OF WATER—RIVERS—STREAMS—TANKS—DIRTY HABITS—RULES TO KEEP WATER PURE—WELLS—RULES FOR KEEPING WELLS PURE—CLEANING WELLS—BOILING AND FILTERING DRINKING WATER—DRINKING WATER FOR ANIMALS.

Now that we have learnt all about the necessity of fresh air and the way to obtain it in our homes we have to learn about the other great necessity of health we spoke of in the chapter on Houses—that is good water.

Water.—Water is like air in some ways. It is made up of two gases chiefly, and contains a few salts when it is pure, and when it is impure it has dangerous organic matters in it just as air has.

Oxygen and Hydrogen.—The two gases which combine to form water are called Oxygen and Hydrogen. Oxygen we already know about, but Hydrogen we do not. Hydrogen is the lightest of all gases and it is the one balloons are generally filled with to make them float up in the air. Oxygen forms the greater part of water for in nine seers of water there are always eight seers of Oxygen to one seer of Hydrogen.

Water in our bodies.—Now we all have a great deal of water in our bodies, more than anyone

would think, considering that our bodies are solid.

But if a man weighs 75 seers, about 56 seers, or as much as two-thirds of that, is water. And if we remember what we learnt in the Physiology lessons, we know that every day we get rid of some of this water from our lungs and skin and kidneys and that every day as much has to be replaced or we should lose weight.

Water in Foods.—We replace it by the water we drink and by the water we take in with our other foods. All foods, except the driest, contain a great deal of water—one seer of meat has about $\frac{3}{4}$ of a seer of water, whilst a seer of flour has two *chittacks* of water.

In this way we take in a great deal of water with our foods, but we still have to drink a great deal besides to make up for all that we lose daily, and it is how to get the purest, cleanest water we can, to drink or to cook our food with, that we have now to learn.

Cholera.—Cholera, which is truly called the "child of dirt," is one of the worst diseases we get from bad water, but there is always plenty of pure water around, just as there is plenty of pure air, if we do not ourselves spoil it and make it impure.

Source of pure water.—Rain.—Now where does this pure water come from and how is it made impure? Pure water comes from the clouds. All the time the sun is shining during the day, its heat is sucking up moisture from all the water on the earth. It sucks it up as vapour which we cannot see until a lot of it collects

and forms a cloud. Now clouds according to their temperature can only hold a certain amount of vapour. When they get cooled down the moisture that falls from them is called rain. Rain we know falls on the earth and soaks into it —some of it goes back into the rivers and tanks from which the sun drew the moisture up, and some soaks down into the earth until it meets with some clay or rock that will not let it pass through, but holds it as if it were in a basin. And it is this basin we reach when we dig a well.

Wells.—Most of the water we use comes from rivers and streams, canals, wells or tanks. In large cities water is often brought from a river or a reservoir in pipes which supply every street or house, and that is a good way to get pure water if the river or reservoir is kept clean.

Dirty habits.—But it is difficult to keep any water clean where people have dirty habits, and the first thing to remember is, to keep all the rules given before for keeping houses and compounds and the air around us clean and sweet-smelling, for the same things make both air and water impure.

Breaking any of the rules of cleanliness is bad enough if a river or stream is large and the water is flowing quickly, but if it is a small stream with the water moving slowly, it soon becomes a dangerous place for all the dirt diseases to start from.

Tank water.—Where drinking or washing water is got from tanks it is doubly necessary

for all the people around to be clean in their habits because water in a tank is stagnant or still, and there is no motion in the water to carry off any dirt or impurity. Yet what dirty things we may see done every day either in or near every tank in India.

Banks of tanks.—People use the banks as latrines, quite forgetting that all the foul matter from their bodies will soak through the ground and be washed into the water they drink—others wash all the dirt and perspiration off their bodies, brush their teeth, rinse their mouths and spit into the tanks, others again scrub their dirty, greasy, cooking pots or wash and water their cattle, while others wash the grain and fruit they are about to sell or eat, and the filthy clothes they have just taken off their dirty bodies, and which simply stink with the dirt of weeks or months.

These are all very dirty habits, and it is only by people knowing all the harm that is done by them, and the diseases that spring up in this way that we can ever hope to get a cleaner and more healthy state of affairs.

Diseases from drinking bad water.—The diseases that come from drinking dirty water of this sort are some of the worst we can have—cholera, dysentery, diarrhœa, typhoid fever, and some kinds of worms,—and these come chiefly through drinking in by our mouths the foul excreta from other people's bowels. Can anything be more horrible to think of? And can anything be more true than calling cholera and these other diseases "dirt diseases."

Rules to keep water pure.—They are dirt diseases, but they are also preventable diseases. Clean habits will stop them if only every one will be clean, and remember the following rules with regard to all water in rivers and streams, canals and tanks:—

(1) Not to throw any kind of refuse or dirt into water, but to get rid of it into a proper trench.

(2) Not to throw dead bodies, or the ashes of dead bodies that are burnt on the banks into any water.

(3) Not to wash clothes, or to bathe in the same place where drinking water comes from.

(4) To have separate tanks for bathing people and washing cattle.

(5) To keep the bathing tank as clean as possible, and not to think that any dirty water will do to wash oneself, or one's clothes in.

(6) To keep one or two tanks with the purest and cleanest water for drinking water.

(7) Where drinking water is taken from a river, or stream, to make a small well or hollow in the sand at the side of the stream, four or five feet deep—so as to form a natural filter. The water will pass through into it, and on its way will get rid of a lot of its impurities.

(8) Not to use the bank of a river, a canal, or any stream as a latrine.

(9) To make sure there are no latrines or refuse trenches near.

(10) To be sure no drains or *nullahs* from houses, or crowded streets near, empty into the tank.

(11) Not to steep hemp or jute or other similar things in water anywhere near a town or village, for when they rot they make both the air and the water impure.

Well water.—All that has been said about keeping rivers, streams and tanks clean, is equally true as regards wells. A great deal of drinking water in India is taken from wells, and although people cannot bathe in them, or wash their clothes in them, still they do many things which make the well water dirty.

How wells get dirty.—They draw up water from it in dirty *chatties*, or pails tied to filthy ropes, and as they raise it up they spill some of the water over their feet on to the ground around and it soaks through from there into the well again. Or again they draw up water and bathe, or wash their clothes close to the mouth of the well, so that the ground all round gets wet, and the dirty water from their bodies or clothes soaks back again in the same way.

Cattle troughs.—Sometimes they build troughs round the well for cattle to drink from; but these are often both cracked and dirty, and through the crack all manner of dirty matters fall back into the water. At the same time the droppings from the cattle fall on to the wet ground all round and soak through the earth into the well.

Rules for keeping wells pure.—Now what ought to be done to keep all well water pure and fit for drinking?

(1) Every well should be sunk in a good soil and not near any refuse pit.

(2) It should be at least thirty feet deep where possible, so that the water in it is not taken from the surface close around. It is a great advantage to have it pass through an impermeable layer, but in India it most frequently happens that the depth varies according to the distance of the ground water from the surface.

(3) The upper part for at least 5 feet from the surface should be built round with a good wall of concrete and brick, and there should be a pucca masonry platform six feet all round the mouth, sloping away from it into a drain leading from it to prevent surface drainage into it.

(4) The top of every well, private or public, should have a wooden cover so that mosquitoes may not breed in it or leaves or dust fall into it. Living plants or fish, we must remember, do good to water, but dead leaves or dead things of any kind do a great deal of harm.

(5) Every well should have a pump to draw up the water with and where possible the mouth of every well should be entirely closed in and the water pumped out—where the water is near the surface tube wells should be driven into the ground and the pump head fixed in masonry. This is especially useful for drinking water in irrigated districts.

(6) If there is no pump, clean *chatties* and clean ropes should always be used.

(7) *Lotas* or *chatties* used by people themselves should not be let down into a well. A clean iron bucket kept for the purpose is the best.

(8) There should be no holes where water can lodge near to a well. If there are any they should be filled in.

(9) The ground all round the well for a distance of 30 or 40 feet should be kept clear of cattle and animals of all kinds and no washing of clothes or people should be allowed in the area.

Cleaning wells.—Wells should be thoroughly cleaned twice a year, but before cleaning a well it is always necessary to let a lighted *chiragh* or candle down or perhaps a small bird in a cage to just above the water. If the light burns it shows the air is pure, and that there is enough oxygen in it for a man to breathe. But if the light does not burn well, or goes out at the bottom, no one should go down, because it shows there is a quantity of poisonous gas in the air. And wherever the poisonous gas is enough to put out a light, it is enough to kill a man.

Poisonous gas in wells.—It sometimes happens that this poisonous gas is let loose in the air by cleaning the well, or by disturbing the decaying matter at the bottom; but if this is the case, it shows the well has not been cleaned for a long while. So if it is known that a well has been left dirty for a long while, it is always safest to keep a light burning in it if men are going down it.

Drinking water.—Perfect cleanliness all round is the best remedy against bad water; but as we can never be sure there is perfect cleanliness anywhere, we should always both boil and filter all the water we drink, and not only all the water

we drink as plain water, but all the water to which spirit or wine is added, or the water with which we make tea, coffee, cocoa, etc., as well as all water from which soda water is made.

Effect of boiling water.—By boiling water we kill any living things or fever germs there may be in it—only it must be really boiled to do this. If it does not bubble and steam it is under boiling point and worse than no good, for heat makes the germs grow up to a certain point. It is only when boiling point, 212° Fahr., is reached and maintained for at least 5 minutes that we can be sure all living things in the water are killed. Boiled water should not be kept too long as it quickly takes up and generates germs. If the taste of boiled water is objected to it can be made more palatable by ærating it.

Filtering water.—Where water is very bad it should be roughly strained through sand or gravel before boiling or filtering. The only reliable filters are those made of infusorial earth such as the Pasteur or Berkefeld. The great objection to these in the Tropics is that they soon get blocked up by the gross impurities found in most waters unless they are first strained. Whatever filter is used must be capable of being cleaned in all its parts and must be cleansed frequently.

Water either for drinking, or for cooking, should always be kept in a closed glazed *ghurra* or jar, where neither dust nor other things can fall into it, and once every day all the water should be emptied out, and the inside of the *ghurra* wiped dry with a clean cloth before fresh is put

in. It should not be kept in an unglazed one, into which the water soaks and in the pores of which germs grow rapidly and pollute the water.

Drinking water for animals.—Besides getting pure drinking water for ourselves, we should not forget that all animals, cows and horses, goats, sheep and dogs all want clean, pure water as much as we do. If they had clean drinking water given them in clean pails or *ghurras* they would not suffer from worm diseases which make them thin and miserable looking—and they would not only be able to do more work but would fetch higher prices when sold. In England all animals are well taken care of, and have good drinking water, and clean places to live in, so they always look fat and well, and can do a lot of hard work.

Test for good water.—A very good rough test to tell whether water is pure or impure, is to drop some permanganate of potash into it. Half a teaspoonful in four or five seers of water is quite enough for the purpose. If the water turns purple it is pure. If it turns a dirty yellow it is impure, and therefore not fit for either man or animals to drink. Permanganate of potash is also used for purifying water and especially when there is any suspicion of a well or spring being contaminated with cholera. A sufficient amount of solution prepared in tins or *ghurras* from the crystals is poured into the water to be dealt with until the whole is a deep red which will last up to about 8 hours. If this is done in the evening the water is fit to drink in the morning.

CHAPTER V.

FOOD—COMPOSITION OF THE HUMAN BODY—SALTS AND PHOSPHATES—GROUPS OF FOOD—TABLES OF NITROGENOUS AND CARBONACEOUS FOODS—WATER AND SALTS IN DIFFERENT FOODS—NECESSITY OF MINERAL SALTS FOR HEALTH—VALUE OF RICE—A GOOD MIXED DIET—SWEETS—MILK—VEGETABLES—ANIMAL FOOD—COOKING FOOD—FRESHNESS OF FOOD.

When we learnt how the food we eat is digested or turned into blood, which feeds all our flesh, bones, and nerves, we learnt something about the chemistry of our bodies, but by no means all.

The chemistry of our food and our bodies alike.—We shall now see that our food, as we might expect, is made up of exactly the same chemical compounds as our body.

Our body we said, in the last chapter, was more than half water—really two-thirds water—and water as we know is a compound of oxygen and hydrogen.

Elements.—Now oxygen and hydrogen are "elements," that is, substances which will not divide up into anything else—and in the same way carbon and nitrogen are elements, because they are simply themselves. There are altogether eighty-one elements which have been discovered, and everything in the world—earth

—fire—air—water—trees—plants—animals as well as we ourselves, and the food we eat—are made up of some of these mixed or combined together into what are called compounds.

Elements in our bodies.—Our bodies, however, are only made up of sixteen of these elements, and seven of these are metals. We have not yet learnt anything about the metals in our bodies, but we do know something about the other elements. We remember, we have oxygen, hydrogen, carbon and nitrogen in our bodies, and that these are the chief elements in us, just as in fact they are in everything in the world.

All the others are in very small quantities. Their names are—Phosphorus—Sulphur—Chlorine—Fluorine—Silicon—Calcium—Potassium—Sodium—Magnesium—Iron—Manganese and Copper.

The last seven are all metals, and iron which is amongst them is found everywhere in the body and is necessary for the colouring matter of the blood. Iron and other mineral matters are always found in the ashes of a body after it has been burnt.

Combination of Elements.—All the first four Elements—Phosphorous, Sulphur, Chlorine and Fluorine—are generally found combined with the metal elements,—Calcium, Potassium, Sodium or Magnesia—and form mineral salts, which are met with in all our tissues and all the liquids of our body, our blood, saliva, gastric juice, bile, pancreatic juice, and perspiration.

Salt.—One combination of these is easily remembered, that is, the gas Chlorine and the

metal Sodium, which unite and form common salt, or as it is called in Chemistry, chloride of sodium. Common salt is always found in our blood, and the gastric juice of the stomach is partly formed from chlorine, whilst bile is partly formed from sodium, and both the gas and the metal are separated inside us, from the salt we eat.

Phosphates.—Of the others, phosphorus is one of the chief, because it combines with oxygen and calcium to make phosphate of lime, and again with magnesium making phosphate of magnesia. Both of these phosphates are found in all our tissues, but mostly in our bones and teeth.

We get these phosphates chiefly from wheat, barley, rice, oats, etc., and they get it from water. When rain falls it dissolves phosphate of lime from the earth and so it becomes soaked up by these plants and enclosed in their grains as they grow. This is truly a very wonderful provision of nature, for both the plants need it for their growth, and we need it for ours.

Silicon, the last of the non-metallic elements, combines with oxygen, and is found in the hair, the nails and bones.

Principal Elements.—In order to be able to understand how food nourishes us, it is necessary to know all this, but chiefly to remember that our bodies are, generally speaking, made up of the first four elements, together with several kinds of mineral salts.

The two first of the elements, Oxygen and Hydrogen, form the water in our bodies; the next, Carbon, unites with Oxygen and burns,

and the fourth Nitrogen combines with other things to form bone, blood, muscle and flesh.

The two last are especially necessary to remember, because foods are divided into two great classes according to the amount of Carbon and Nitrogen each contain.

Carbonaceous foods.—Those which contain most carbon are called *carbonaceous*, or heat-giving foods, because the carbon in them becomes united with the oxygen in our body and burns, or in other words, helps to supply our animal heat.

Nitrogenous foods.—Those which contain most nitrogen are called *nitrogenous* or flesh-forming foods, because most of our flesh and bone is formed from nitrogenous compounds.

Salts, or Mineral foods.—The above are the two great classes, but there is also a third class of necessary food, and that is divided into two groups, the first being *water*, the second *salts* or mineral matter.

Waste and Repair.—There are two reasons why we eat food :—The first, to repair the waste of the body which is continually going on. The second, to supply animal heat.

Every day and every minute of our lives we are continually using up part of our body—or, as we know, throwing out waste substances from our blood which are got rid of by our lungs, skin, kidneys and bowels. Every time we move a muscle, or think, or speak, or walk, or breathe, some of this waste takes place and has to be got rid of. But it also has to be replaced, or our bodies instead of growing larger

and stronger as we grow older, would grow less and less. And it is by the air we breathe, the water we drink, and the food we eat, that this waste is replaced, and fresh fuel for keeping up the animal heat supplied. Now there is only one food which has all the elements in it which are required to supply both these necessities, and that is milk, the food we have first as babies, and which gives all we want to make us grow strong and fat in the first few months of our lives.

Milk.—The perfect food.—What then is milk made up of? If a seer of cow's milk is analysed, that is, divided up, it is found to contain about $13\frac{3}{4}$ *chittacks* of water—about $\frac{3}{4}$ of a *chittack* of sugar—about $\frac{1}{2}$ a *chittack* of butter, $\frac{3}{4}$ of a *chittack* of caseine—about $\frac{1}{4}$ of a *chittack* of salts, and a little iron.

In the water and salts we get the necessary proportion of water and mineral food—in the sugar and butter we get the necessary carbonaceous, or heat-giving food, and in the caseine we get the necessary nitrogenous or flesh forming food.

Now we have to learn which, amongst all the many foods we eat, are nitrogenous and which carbonaceous.

Albumen.—Nitrogenous, sometimes also called albuminous, foods are those which contain a lot of albumen, fibrine or caseine. The white of egg is albumen, the fibres of flesh, or meat is fibrine and the solid part of milk, or cheese is caseine, and this is the part in which the nitrogen is found.

Carbonaceous foods, on the other hand, are those which contain a lot of starch, sugar or fat, that is, substances which are nearly all pure carbon.

List of chief Nitrogenous foods.—The chief nitrogenous foods are:—

Animal.	*Vegetable.*
Meat.	Barley.
Fish.	Oatmeal.
Fowls, ducks, &c.	Lentils.
Eggs.	Maize.
Milk.	Rye.
Cheese.	Millet.

All the above contain Oxygen, Hydrogen, Carbon and Nitrogen.

Chief Carbonaceous foods.—The chief carbonaceous foods are:—

Animal.	*Vegetable.*
Butter and ghee.	Sugar.
Suet.	Treacle.
Oil.	Olive oil.
Fat.	Starch (which is in flour and all vegetables).
Dripping.	

Chief Mixed food—

Bread.
Flour (all kinds).
Rice.
Chapatties.

We see from these lists that there are many different kinds of both animal and vegetable food in both classes, but although they all sound

equally good, some are really a great deal stronger and better for us than others.

Proportion of Nitrogen and Carbon in different foods.—Here is a list of some of our chief foods in the proportion of their richness:—

	Nitrogen.		Carbons.
Cheese	28	parts in 100	24·0
Raw meat	20·5	,,	8·5
Dry Peas, Lentils, Gram ...	22 to 24	,,	
Oatmeal	16	,,	73·1
Millet	16	,,	
Eggs	13·5	,,	11·5
Fish	14	,,	
Maize	9	,,	69·5
Bread	8·0	,,	50·5
Rice	9·34	,,	78·23
Barley	11·45	,,	67·76
Figs and dates ...	6	,,	66·
Milk	3·50	,,	8·5
Bananas	4·8	,,	20·3
Sago, tapioca, arrowroot, corn flour ...	6	,,	83·
Pearl Barley ...	6·2	,,	77·3
Fine flour (*maida*) ...	10·5	,,	75·3
Wheat	15·53	,,	67·76
Rye	10·5	,,	72·6
Sweet Potatoes ...	...	,,	16·
Potatoes	...	15 parts in 100	
Parsnips	...	3 parts in 100	
Sugar, treacle, butter, ghee, suet or fat.	Have about 90 parts in 100 of pure sugar or fat.		

Proportion of Carbon and Nitrogen compared.—If we compare these two columns, the thing that must first strike us is the fact, that the flesh-forming foods have much less nitrogen proportionately than the heat-giving have of carbon. Dry Peas, for instance, which come high up in the list have only 22½ parts of nitrogen in every 100—that is, nitrogen forms less than one-quarter of their whole weight. Raw meat, again, has a little less than a quarter of its whole weight nitrogen. But if we turn to the carbonaceous we see that sugar, butter, and fat consist nearly entirely of carbon, whilst sago, tapioca, arrowroot, cornflour, pearl, barley, rice and *maida* have ¾ or more of their whole weight starch or carbon—and even many of those lower in the list have more than ½ their weight carbon.

Amount of Carbonaceous food eaten.—Now this is very instructive, for it shows that we are always eating far more heat-giving food than flesh-forming. If we could see all the calculations made by clever men as to the daily loss and gain of our bodies, we should see that we want a great deal more carbon to burn in our bodies than nitrogen to supply the waste in our muscles and tissues, so that it is quite right to eat more carbonaceous than nitrogenous food.

Effects of too rich living.—However we must not eat too much carbonaceous food, that is, more than we require to keep up our animal heat, for if so, the superfluous carbon stays in our bodies, and forms fat in all parts of us—in our organs and between our muscles—whilst

if we eat too much nitrogenous food, blood is formed too freely, our organs do not require it all, and they become congested, and so get diseased. This means we must never overload the stomach with any kind of food—although if we are doing hard work, or taking a lot of exercise, a good deal more can be taken than if we are doing next to nothing, as we require it to produce force and repair muscles.

Now that we know how much nitrogen and carbon we get in a good many of our ordinary foods we must see what they are made up of besides, and this is not difficult to remember, as it is mostly water and mineral salts which, as we know, form the third class of necessary foods.

Proportion of Water and Salts in several foods. —All foods contain water and mineral salts, though some have much more than others, as may be seen from this list :—

The food.	*Water in 100 parts.*	*Mineral salt in 100 parts.*
Vegetables and Fruits, such as Onions, Lettuce, Cabbage, Carrots, Rhubarb, Apples and Parsnips.	Between 80 and 95 parts.	One part or less.
Milk	86·3	0·8
Sweet Potatoes ...	74	1·5
Potatoes ...	75	1·0
Fowls and lean meat	73	2·0
Bananas ...	73·9	0·8
Eggs	71·7	1·3
Bread	40	1·5

The food.	*Water in 100 parts.*	*Mineral salt in 100 parts.*
Cheese ...	... 34	nearly 5
Dates ...	... 20·8	1·6
Figs ...	... 17·5	2·3
Rice ...	... 14·6	0·5½
Flour (wheat)	... 14	1 to 6
Peas ...	... 14·3	3·0
Haricot Beans	... 14	2·9
Maize meal	... 14	1·35
Barley meal	... 14	2·32
Butter ...	... 10	1·5
Oatmeal	... 5	3·0

Wet and dry foods.—From this we see that most green fresh vegetables are very wet foods, as they are nearly all water. Next, that potatoes, fish, fowls, meat, eggs and bananas have about ¾ of their weight made up of water, whilst rice, peas, beans (*dal*), barley, wheat or maize, dates, figs, &c., have only between an eighth and a fifth of their weight water, and are therefore very dry food. This shows us that rice, *dal* and all dry foods are cheaper for a poor person to buy, because as they have only a small quantity of water in them they must have a great deal of solid carbon and nitrogen.

Again, if we look at the amount of mineral matter in different foods, we see that flour, cheese, oatmeal, peas, beans, meat and figs contain a great deal of mineral matter, that is, 1 to 2 or more parts in every 100—whilst rice contains only ·5 or ½ a part in every 100.

These mineral matters, or different kinds of salts, are all very important to us. We require

a great deal of one kind—common salt—and we get some of it in a great many of our foods, but not nearly enough, so that we always eat it separately as well, if we wish to remain in health. People who live only on vegetable food require a great deal more than those who mix animal and vegetable foods, because there is very little common salt in any kind of vegetable.

Necessity of mineral salts—Scurvy.—The other mineral salts, the phosphates, sulphates, and salts of potash are all supplied to us in our food. It is important to remember this, for if we do not have enough phosphates our bones and muscles are weak, and little children grow up with crooked spines and legs; whilst if we do not have enough salts of potash our blood is thin and poor, we get skin diseases and sometimes a dreadful disease called Scurvy. Now some foods are much richer in these salts than others.

Phosphates in cereals.—For instance, all cereal plants, seeds, fruits and animal food contain a great deal of phosphorus in their mineral matter. Wheat and wheat flour are the richest in all kinds of phosphates, but barley, oats, rye, rice, and maize all contain phosphates too.

Potash in vegetables.—On the other hand, potatoes and all green vegetables, cabbages, turnips, carrots, pumpkins, onions, brinjals, contain a great deal of the salts of potash and lime, so that eating wheat, &c., will make the bones strong, and eating plenty of green vegetables will keep our blood pure.

Rice.—Poorness of rice.—Rice, strangely enough, which is the common food in India, was, as we saw, very poor in mineral matters or salts—and it is also poor in nitrogenous matter. The average nitrogenous matter is 7 per cent. though this varies from 5 to nearly 12 per cent. according to the different soils on which it is grown.

These two facts show us clearly why it is that people who feed on rice alone can never become strong like other people who eat foods which are richer in nitrogen and mineral salts. All who have to do hard work must eat plenty of nitrogenous food to repair their muscles, as well as plenty of carbonaceous food to produce the force or power to move those muscles.

Digestibility of rice.—Still rice is a very good food for more than one reason. It loosens the bowels less than any other of the cereals and it is supposed to be the most digestible of all foods, that is, the starch in it is more easily digested than other kinds of starch. Rice should not be boiled but steamed. When boiled in water it yields up many of its nitrogenous and mineral constituents—those in which it is most deficient. Steamed rice with its starch grains properly swelled out in cooking takes only an hour to digest, whilst beans, barley, or potatoes take over two hours, and meat over three hours—so that rice is sooner changed into blood and gives the stomach less work than any other kind of food. Rice is husked before being used for food, but it is also polished to prepare it for the market. This may make it look nicer but in the process essentials are removed which

are very necessary to health, especially in the absence of other articles of diet. The disease known as Beri-Beri, which is common in Bengal and other rice-eating countries, is said to come from the want of these.

A good mixed diet.—Rice, however, is too dry and starchy to be a strong or perfect food, and those people are healthiest and can do the most hard work who can afford to add *dal* (peas or beans or lentils) or gram or *chapatties* made from the flour or wheat (*gehun*), barley (*jow*), maize or Indian corn (*mukkie*), spiked millet (*bajra*, *cumboo*), common millet (*ragi-murwa*).

Amount required daily.—The amount of food in addition to water, that grown-up people require every day is at least 1½ *chittacks* nitrogenous, 9 or 10 *chittacks* of starchy food, ½ or ¾ of a *chittack* of butter or sugar and ¼ of a *chittack* of common salt. Anyone eating this amount would be taking the right proportions of flesh-forming, heat-giving and mineral foods, and would neither have too much nor too little to keep himself in good health if he were doing an ordinary amount of work, and if the food was properly cooked.

Now all kinds of *dal*, gram and flours are richer in nitrogen and mineral matter than rice, so that they supply what rice lacks, and are useful in giving variety to the daily food.

Atta, Soojee and Maida.—It must be remembered, however, that there are three kinds of wheat flour—*atta*, *soojee* and *maida*,—and that *atta* should always be used for making *chapatties* as a supplement to rice food.

Atta is rich in flesh-forming and mineral substances, whilst *soojee* is principally albumen and starch, and *maida* is nearly all starch and so only a carbonaceous food.

Milk and vegetables.—If people, in addition to rice and the foods named, can get plenty of milk and fresh vegetables besides, and do not take too much *ghee* or sweetmeats, they will have as good and as healthy food as it is possible to eat. Too much *ghee*, or too many sweetmeats are bad, because they are only heat-giving foods and unless people are taking much exercise they will not make them healthy but only fat.

Milk.—Milk is a very good food especially for children because it contains everything our blood needs, and if it is added to rice with a little sugar, it makes a most nourishing food and digestible dish. It is a very good thing also to mix with cornflour, sago or arrowroot, which are nearly all starch, because in this way nitrogenous matter and mineral salts are added.

Vegetables.—Fresh vegetables are especially necessary to eat all the year round so that our blood may have the potash salts it requires. Salads and fresh uncooked vegetables or fruits have more of these salts than cooked vegetables except when they are steamed instead of boiled, because the salts are lost in the water they are boiled in ; but in the hot weather it may not be always safe to take uncooked vegetables or fruit, particularly if Cholera or Dysentery is about.

Fruits, &c.—Mangoes, plantains, melons, pine-apples, peaches, dates and figs, oranges and lemons all contain either valuable mineral

matter, or a special acid, which is very good for the blood.

And in the same way, potatoes, spinach, cabbages, carrots, turnips, onions, tomatoes all kinds of *brinjals*, pumpkins, cucumbers, *kuddu* or vegetable marrows, *bhindi*, and *kerila* contain a great deal of the necessary salts of potash. Vegetables are sometimes difficult to get in the hot weather, but nearly all of these varieties may be had if a garden is properly looked after. Fresh *gram* leaves and turnip tops, which are generally thrown away make a good dish for a change, very much like spinach if cooked in the same way.

Rice, which some people eat as a vegetable, is no use instead of green fresh vegetables or potatoes. It has so little mineral matter that if eaten for long as a substitute for other vegetables scurvy results.

Animal food.—People who eat much animal food of any kind, either mutton, goat, fowl or fish, should always take plenty of vegetables because all animal foods are very rich in nitrogenous matter, and require lighter foods, especially those which contain salts of potash, to mix with them. All meats, besides having a great deal of nitrogenous matter, are well supplied with phosphates, but we know that where too rich nitrogenous food is taken, more blood than we require is formed, so that unless plenty of fresh vegetables are eaten the blood must soon become unhealthy.

Salt meats.—Salted meats, especially, require a great deal of fresh vegetables with them, or

they cause scurvy. If fresh vegetables cannot be had lemon-juice is a good substitute.

Cheese.—Cheese is a food which is also very rich in nitrogenous material because it is mostly made from the curd, that is, the solid or nitrogenous part of milk. It should always be eaten with plenty of bread or *chapatties* and water, together with fresh salad or vegetable.

Eggs.—Eggs again are a very nourishing food as they contain about as much flesh-forming and heat-giving substances as an equal weight of meat. If they are eaten raw they only take $1\frac{1}{2}$ hours to digest, but if hard boiled $3\frac{1}{2}$ hours, because the white or albumen is hardened and takes two hours longer for the juices of the stomach to dissolve it.

Condiments.—Black and red pepper, mace, ginger, cloves, garlic and other condiments or spices are all very good to mix with food in small quantities, as they make it both more tasty and more wholesome, but if they are taken too strong they have a bad effect on the digestion.

Drink.—As regards drinks—the best drink for grown-up people in good health is pure boiled water—for children, either boiled water or good milk, or barley or oatmeal water.

Spirits.—Spirits or wine are not necessary to health, and if taken frequently, or in excess, they cause diseases of the liver and inflammation of the mucous membrane of the stomach.

Spirits are more hurtful in a hot climate than a cold one, and those who make long marches or hunting excursions in India will find hot

tea or coffee far better and healthier to drink than any kind of spirit or wine.

Cooking.—Besides knowing what different kinds of food consist of, so that we may judge which are the best and the most nourishing to eat together for our everyday food, we must know how to cook foods properly, so as to bring out the greatest amount of nourishment.

Cooking prepares food for our stomach by softening and heating it. If we were to eat raw or cold food always, our stomachs would not be able to go on working very long, but would become weak and diseased.

Cooking starchy food.—Some foods require more cooking than others. Generally speaking all foods, such as rice, which are hard and dry and contain much starch, require a great deal of heat and moisture to make them digestible.

Influence of cooking on starch cells.—With rice, as with all other grains, and all kinds of *dal*, the most nourishing part is enclosed in very strong, tough coverings or envelopes, which it is impossible to digest—so that unless this tough part is first broken through by cooking no good is got out of the food. And not only should the tough covering be broken through, but these starch grains should all swell out and become soft in cooking or when we eat them the salivary glands cannot change them into sugar in the short time they are in our mouths. Yet, until starch is changed into sugar, it cannot pass into our blood, so that we get no good from it unless it is so changed. Some kinds of starchy

foods take much longer to convert into sugar when eaten raw than others, but when they are all properly cooked one dissolves as soon as the other. Thus, uncooked rice or Indian corn starch, requires three minutes in our mouths before the starch is changed into sugar, oat starch requires six minutes, wheat starch forty minutes, and potatoes starch three hours. The reason is that in some the starch granules or envelopes are much harder than others, and so take a longer time to break through, but once they are broken through by proper heat and moisture in cooking all the starch cells alike become a kind of paste or jelly which is easily acted upon by the saliva.

Even well-cooked starchy foods should, however, always be held in the mouth long enough for the saliva to mix with them, as no amount of cooking will change the starch into sugar, and as it is also impossible for the change to take place completely in the short time we have each mouthful of food in our mouths; but if saliva is well mixed with food the change goes on after we have swallowed it.

Steaming.—The best way to cook all starchy foods is to steam, and not boil them. If we put rice for instance into water and let it boil a long while and then throw away the water and eat only the rice, we shall have done a very stupid thing, for a lot of the nitrogenous matter and all the mineral salts which are so good for us, will have escaped into the water—we shall get none of them and our dinner will be only starch and water with whatever salt we may add.

Cooking rice.—The proper way to prepare rice is to wash it thoroughly in cold water first, then to steam it till tender. If this is done the starch grains will swell out to three times their size and all the goodness will be kept inside the rice.

Cooking potatoes.—In the same way, if we want to get the most goodness out of a potato we should either steam it till it is soft, over boiling water, or boil it without taking its skin off. If the skin is left on in boiling, or if it is baked in its skin, all the mineral salts and the best of the potato remain inside. A potato boiled without its skin takes 3½ hours to digest, whilst one baked or boiled in its skin takes only two hours. This is because the one in its skin loses none of its juices or salts and the salts and juices all help digestion.

Boiling.—More goodness is as a rule lost in boiling than in any other way, and not only in boiling rice and starchy foods but in boiling meat. For even where boiling is properly managed a great deal of goodness and especially the salts of different kinds of food are lost. To boil meat or any vegetable nitrogenous food, such as *dal*, properly, the water used should first of all be boiling, and kept boiling for five or six minutes, until the outer part of the meat or *dal* is hardened so that none of the juices or salts run out. Then it should be cooled down by putting in one or two seers of cold water to about 180° Fahr. If it is cooked in boiling water, that is, 212° Fahr., the whole time, all the albumen becomes hard and is less

easily digested, just as the white of an egg becomes hard if boiled too long.

Roasting.—It is the same with roasting meat. It should first of all be put very close to a hot clear fire for about five minutes until all the outer skin is hardened, and then should be drawn further away where the heat will gradually go right through it, melting up the fat from the fat cells, and preparing the albumen in such a way that it can be easily dissolved by the juices of the stomach. Recently in England we have taken to cooking many kinds of food in Paper Bags invented by M. Soyer a celebrated cook. It is a very simple and a very economical way and keeps all the goodness and juices of the food in. A particular kind of grease proof paper bag is required, but these can be bought at Stationers shops. All that is necessary is an oven, a grid and the paper bag. The grid is required because the heat must pass *underneath* and all round the paper bag to effect the general penetration of the contents of the bag. Copper poisoning or dirt from cooking vessels is avoided and it prevents the food shrinking or losing its natural flavour or substance. It is a preventive too of the congregation of microbes that often start disease, as absolute cleanliness is assured. Those who wish to try it should study a small book on Paper Bag Cookery by Soyer and then try their hands on some appetising dishes. Meat either roasted or boiled in the proper way should keep all its goodness inside, so that when it is cut the juices gush out and flow on to the dish.

Soup.—On the other hand, if soup or beef-tea is being made, the great thing is to get all the juices and salts *out* of the bones, meat or fowl, and to leave only the fibres or stringy parts. The meat or bone should therefore be put into cold water with a little salt and a few vegetables in a closed vessel and allowed to heat slowly and simmer as long as possible so that all the goodness comes out.

Chapatties.—Again *chapatties*, which form a part of the daily food of so many people, require careful baking or they produce indigestion, wind and uncomfortable sensations, sometimes even actual pain. When *chapatties* are light and well baked so that they are blown out with air in the centre, the starch grains are all swollen out and ready to be digested, but if they are heavy and under-cooked they give the stomach a lot of work with very little nourishment.

Bread.—Bread, as European people eat it, is much more digestible than *chapatti*—and the reason is that it is leavened, that is, mixed with yeast or some ferment, whilst the other is unleavened, or without anything to ferment it.

Leavened bread.—In flour that is leavened some of the starch in it becomes changed into *glucose*, which we know is a kind of sugar—this sugar then ferments and produces carbonic acid gas which swells the bread out and makes it light and digestible.

Choosing foods.—Not only must we know the general principles of the proper cooking of food,

but we must know how to choose food that is wholesome, fresh and fit to eat.

Meat.—As regards meat: all lean meat when fresh has a deep purplish-red tint with a bloom over it on the outside of the muscle and a paler vermilion red with just a shade of purple on the cut surface. Mutton lean should be quite even in colour and have no flavour of tallow—whilst beef lean may be a little marbled with fat, but it must have no flavour of suet. Mutton fat should always be very white—whilst beef fat should be slightly yellow. A single joint of meat should have very little smell nor should it waste much in cooking. Generally for all meat, a good test is to push a clean knife up to the hilt into its substance. In good fresh meat the resistance is equal, but when some parts are softer than others it is a sign that the meat is changing. The smell of the knife is also a good aid. Good meat is neither too pale nor too dark—if very dark it is probably the flesh of an animal that has died and not been purposely killed.

Fowls.—In good tender fowls and birds the feet and leg joints are large, supple and a good light colour. If a bird has a thin neck and violet thighs it is decidedly old and tough. A good way to make a fowl look nice for the table is to lay it back downwards on a flat board and press the breast in with the flat of the hand until the ribs crack slightly. This forces more meat up on to the breast.

Fish.—As regards fish—only those fish should be eaten which come from the sea, or from clear running streams. They should be eaten whilst

quite fresh and should be thoroughly cooked. When fish are really fresh, their eye-balls are full, their gills a bright pink colour and the flesh when cooked is firm. When stale, the eyeballs are sunk, the colour of the gills changed and the flesh will be flabby and stringy if cooked.

Stale or half-cooked fish are most dangerous, sometimes causing diarrhœa, sometimes tape worm and other parasites.

Eggs.—Fresh eggs are not difficult to choose, if it is remembered that fresh ones are always heavier than stale ones, and that if held up to a candle or lamp the fresh are transparent in the centre and the stale at the end.

Eggs get lighter by being kept because some of the water passes off through the shell. Very stale eggs get so light that they will float even in plain water.

Test for eggs.—A good test in choosing eggs is to dissolve $\frac{1}{2}$ a *chittack* of common salt in a $\frac{1}{4}$ of a seer of water, and to put each egg in by turns. If good they will sink, if bad they will float.

Milk tests.—To test milk two instruments have been invented, one called a lactometer, the other a creamometer—and if people do not keep their own cows, or have any suspicion that the milk supplied them is not as good as it should be, it is a good thing to know how to use both tests.

Lactometer.—The lactometer shows the density of the milk in which it is placed by means of figures graduating from 1,035 down to 1,000. If milk shows less than 1,024, one may be nearly certain water has been added, though

it will vary from perhaps 1,031 downwards according to the temperature. Milk at 60° Fahr. would have the specific gravity range from 1,030 to 1,034.

If water has been added there is a loss of 3° for every 10 per cent. of water added—that is, when the milk is about 60° Fahr. This method is an easy way of testing milk, but it is not perfect, and it often becomes necessary to estimate the cream or fat, in the milk too, to see if this has been removed.

As regards other articles of food—

Rice.—Rice when it is good, is whole and not broken, free from dust and dirt, and with no trace of weevils or black specks in it. It is not a food which we require to get fresh or new, but rather old and good, as it should never be eaten until it is three years old. New rice is not at all easily digested, and if eaten before it has been kept at least six months, will almost certainly cause indigestion, diarrhœa and other digestive troubles.

Flour.—Flour from wheat should have no smell, and be quite white or only slightly yellow—if it is very yellow or gritty it shows the starch grains are changing and that bread or *chapatties* made from it will be acid. The custom of drying wheat in heaps after it has been washed to clean it is often the cause of acid flour, because the sun cannot dry it right through a big heap and the flour made from it ferments and becomes acid. If wheat must be washed it should be spread out in small quantities and dried quickly.

When flour is good, some of it will stick, if it is thrown against a wall or board—and dough made from good flour will stick well together and draw out easily into strings. If flour has a bad or dark colour, it shows either that it is old, or that it has had other grains, such as rye, mixed with it.

Fruit and vegetables.—In choosing fruit or vegetables the best test is the touch—if fresh they are crisp and firm but not hard, and break off clean and straight—if stale they are tough and flabby and can be bent considerably without breaking. Very soft, over-ripe fruit is unsafe to eat at any time, but especially when cholera and dysentery are about. In the same way cucumbers, salads, or other vegetables that are taken uncooked, are dangerous to eat after they have been long gathered. Every moment any fruit or vegetable is kept after it has been cut or gathered makes it less digestible, especially in a hot climate where decay so soon sets in. If fruit or vegetables are to be used for preserving for the hot weather, it is doubly necessary to gather them quite fresh and to preserve or pickle them on the spot.

Cleanliness of foods.—Good food to eat depends upon other things besides merely choosing it well, for no food however good will be wholesome, or taste nice if it is kept in dirty places, or put into dirty vessels.

Uncooked fruits or vegetables should always be well washed in clean filtered water before eating, and no fruit that has been cut open and exposed to the dirt and dust of a bazaar should

ever be eaten. Fruit and vegetables are not infrequently washed in dirty water perhaps laden with the germs of cholera or some other disease before being exposed for sale and thus produce disease.

Meat should always be hung up in a wire-gauze or muslin safe, where the air can get to it, but where no flies or other insects can settle on it. Fish should be laid on a clean dish either in a wire safe or with a thin cloth over it, for the same reason.

Milk-cans.—Milk should always be put into tin vessels or *glazed chatties*. If a *chattie* is not glazed, no amount of scalding with hot water will remove the grease and sediment from the milk that soaks into its surface, because it is soaking into the substance of the *chattie* all the time the milk is in it, and not only if it is left dirty. All milk-cans or *chatties*, as well as cream pans, should be placed in cold water to which a little solution of Permanganate of Potash may be added and then scalded out thoroughly with boiling water, every day directly they are emptied. Milk will not keep sweet, nor can good butter be made from cream set to rise in pans that are not perfectly clean. Great cleanliness is necessary with everything used in making butter, whether it is a bottle or proper churn and whether it is a wooden mould or a grooved butter-spat. All of these things must be well scalded immediately they are finished with. If they are put away dirty it will take twice the time to clean them later on.

It is also just as important to keep everything clean in preparing and storing *ghee*. If *ghee* is not made and kept in clean vessels it turns rancid, and becomes unwholesome and indigestible, just the same as butter.

Cleanliness in children's food.—Again, every thing connected with children's food should be kept very clean. Nothing upsets a child sooner than food which is slightly sour, either through being kept too long, or through being put in dirty vessels. A baby's feeding bottle should above all be kept very clean. Two bottles are best, so that one can be laid in clean cold water whilst the other is being used.

CHAPTER VI.

PERSONAL CARE OF HEALTH—CLEANLINESS AND CARE OF THE SKIN—THE EARS—THE EYES—THE HAIR—THE TEETH—THE BOWELS—EXERCISE AND GYMNASTICS—SLEEP—CLOTHING—CARE OF CHILDREN—EARLY MARRIAGES.

Personal care.—The personal care of health, that is, each person's care of their own health, is closely connected in many ways with all that has already been learned. The choice of a house, the cleanliness of its surroundings and the ventilation of its rooms, as well as the question of good water and wholesome food are all subjects which have to do with the health of all, but there are many small ways besides, in which each individual can alone regulate or preserve his or her health. These are in bathing and washing the body, in taking the proper amount of exercise and sleep, in wearing sensible clothing, and in obeying the laws of health in every way. All of these are equally important, and no one who wishes to keep in good health can afford to neglect any one of them.

Bathing.—Bathing is necessary to keep the skin healthy. The skin, as we remember, is one of the excretory organs, and it is constantly getting rid of water and acids from the blood through the millions of little sweat glands on it surface.

Cleanliness of the skin.—Now if the skin is not washed thoroughly all over every day, the little pores become clogged up with their own dirt, mixed with the dust in the air around us and the fluff off our clothes ; and when this happens the perspiration cannot run out as it ought to. Wherever this is the case and the skin cannot act, not only may the skin get diseased, but extra work has to be done by the lungs and kidneys, and they often break down and get diseased too. So that it is never a wise thing to have the body dirty. Even if the skin does not get clogged, and perspiration flows away freely, as it often will, simply because a hot climate keeps the pores open,—it should not be left unwashed, because the perspiration and the scales which are constantly rubbing off our skins soon begin to decay, and cause that strong disagreeable smell which dirty people always have ; besides tending to harbour insects, lice, bugs and fleas which lead to disease being passed from one person to another.

Soap and warm water.—The only way to keep the skin clean and sweet-smelling is to bathe every day in clean cold or tepid water, and at least once or twice a week to soap the body all over. The best is clear, yellow soap, not any cheap scented kind, and it should be put on with a flannel or something coarse, the body well rinsed after it and then rubbed hard with rough towels. There is always a certain amount of greasy or oily matter in the perspiration, and water alone can never take this away. There need be no objection to using soap by any one

as it can be obtained made from vegetable oils as well as from animal fats. Soap will mix with grease and remove it, but water will not, any more than it will mix with oil, if we pour both together into a glass.

Time to bathe.—The bath should be taken every morning on first getting out of bed to wash away all the perspiration of the day and night, and make people fresh for their day's work. This is the best time, but if it is not possible to have it then, any other time must do, except just after a meal. It is bad to bathe too soon after a meal, because whilst food is being digested, a great deal of blood is wanted in the stomach and bowels—whereas if a bath is taken, the water and the rubbing both cause a rush of blood to the surface of the skin. For this reason, a bath if taken after a full meal will cause indigestion and sometimes even a fit.

Pouring water over the head from *chatties* or pots is a good way of taking a bath in-doors or out, but specially in the open air, if accustomed to it, because if a cold wind happens to be blowing at the time, the exercise in lifting and emptying the *chatties* prevents people getting a chill.

Bathing in cold weather.—Perfect cleanliness of the skin is one of the best preventives against small-pox, cholera and all other dirt diseases, so that people should bathe and keep themselves clean in hot and cold weather alike. In the cold weather in Northern India some people think it is too cold to bathe, but if they remembered that their skin never ceases throw-

ing off perspiration and waste matters, and that the clearer their skin, the clearer is their mind, and the better their health, they would no doubt wash their skin all the year round.

Washing the ears.—The cleanliness of one's whole body of course includes the cleanliness of the ears, the eyes, the hair and the teeth; but these are very seldom properly attended to. In cleaning the ears it must be remembered that we need only wash the outer ear, because the ear itself supplies a wax which keeps the little curved passage to the inner ear clean.

The wax.—If this wax is left alone it dries up into fine little scales, and these peel off one by one and fall out without being noticed, leaving a clean surface behind them—whilst if soap and water is put in and then the end of a towel screwed up and pushed in, this wax gets squeezed down into hard little lumps, and presses on the drum of the ear, causing inflammation and often deafness. No towel or cloth of any kind should ever be pushed into a baby's or child's ear. It is quite enough to wash anyone's ears as far as the finger can reach.

The eyes.—Babies' eyes.—The care of the eyes is another most important matter. More people suffer from eye diseases in this country than in any part of the world, and it is generally because people are so careless and dirty in their habits. A baby's eyes should be attended to directly it is born—they should be washed with the greatest possible care, with a fine linen rag (a fresh piece for each eye), that has been well

boiled and allowed to cool down and *no soap*. The eyes must be washed carefully and gently until quite clean. If they are left unwashed they may not only become inflamed so badly as to destroy the sight—but if any fluid or matter from the child's eyes touches or gets into the eye of any one else, either a child or grown-up person, they may get the same disease. Everyone's eyes should always be washed when they get up in the morning, in clean cold water without soap. If they are kept clean they will not want smearing with grease or other things.

The head and hair.—The proper way to keep the head and hair clean is to brush and comb it well every day, and to wash it with warm water and soap or *ritah* every week or ten days. If the hair is allowed to get so dirty that insects make their home in it, either skin diseases are produced, or swellings form over the eyes, or the glands in the neck become enlarged, forming unsightly lumps or swellings. Vinegar is a good thing to rub into the hair and head to get rid of these pests.

The teeth.—Cause of decay.—The teeth ought also always to be perfectly clean, as it prevents them decaying, as well as keeps the mouth and breath sweet. When we remember how important our teeth are in helping digestion by masticating our food properly, we shall see that the longer we can keep them from decaying the better our health will be. All people perhaps have not the opportunity of cleaning their teeth with a brush and good tooth-powder after every meal, but it is quite possible for

every one to rinse their mouth out with clean water, and so remove all the little pieces of food which are sticking to their teeth. If little bits of food are left sticking between the teeth, the heat and moisture of the mouth makes them soften and ferment—then the enamel becomes discoloured, gets soft and the tooth decays.

Good rules for the care of the teeth are :—

(*a*) Brush the teeth night and morning, *particularly* before going to bed at night.

(*b*) Brush the teeth or rinse the mouth out after each meal.

(*c*) Use a simple tooth powder such as precipitated chalk alone or 8 parts of this with 1 part each of borax, powdered orris root and powdered myrrh. Finely powdered charcoal may also be used.

(*d*) For a mouth wash use a couple of pinches of bicarbonate of soda dissolved in half a tumblerful of water.

(*e*) Use a tooth brush with fairly stiff bristles in groups a little apart from one another so that they roughly correspond to the intervals between the teeth. The brush should be well cleaned after using and kept in a closed receptacle away from dirt and dust. The *kikar dataun* if the surface used is frequently renewed, may be used with advantage and is effectual; but it must be used with care so as not to injure the gums.

(*f*) Brush all the teeth, both back and front inside and out, upwards and downwards so as to get between the teeth and not across them.

(*g*) Do not stop cleaning the teeth because they ache or because the gums bleed. If the teeth ache they probably want attention from the Dentist and if the gums bleed much you are very likely in bad health and should see a Doctor.

(*h*) Teeth should be stopped before they ache, *i.e.*, directly they begin to decay, and, so it is better to have them regularly examined by a Dentist.

(*i*) Always remember that nothing keeps your teeth in order better than the thorough chewing of your food and that the partaking of fruit after each meal is of great assistance.

(*j*) Often the food cannot be removed from between the teeth by the brush ; in this case a waxed silk or wool thread may be passed between the teeth and drawn upwards and down and backwards and forwards, or a quill tooth-pick may be used.

Betel-chewing.—Of course teeth decay from other causes as well, but this is one of the chief, and perfect cleanliness is the only remedy for it. If people kept their mouths clean, no doubt they would leave off the dirty habit of betel-chewing which is very bad for the teeth, and some times causes cancer of the mouth.

Bowels.—Attention to the proper action of the bowels is another matter of personal care. Mind and body are both more healthy and clearer when the bowels are kept regular, and it is easy to manage this if the habit is formed to make them act at a certain time every day by persistently trying to make them act at that time.

It is difficult to explain why this is, but it is certain that the body can be trained to repeat actions periodically, and almost unconsciously, after a little exercise of the will the bowels will generally act regularly, if sufficient exercise and proper food are taken.

Walking, its influence on the bowels.—Exercise, especially walking, keeps the muscles of the abdomen in good order, and helps the contractions of the intestines whilst food is being pressed through them—and proper food causes the necessary secretions to be formed to digest the food. It is chiefly when lazy habits and indigestible foods are indulged in, that the bowels get out of order.

Constipation and diet.—Opening medicines harmful.—Generally an alteration in the food will set matters right—such as taking a tumbler of cold or tepid water first thing in the morning or eating figs, oatmeal and coarse flour, with plenty of fruit and green vegetables. But if this does not mend matters, it is better to go to a proper doctor for advice and not to take quack medicines or get into the habit of taking opening medicines. Most opening medicines, if taken often, weaken the digestion and do harm rather than good in the long run. If opening medicine is taken however, it is better to take two weak doses two nights running, than one strong dose on a single night—but an enema of soap and water is often better than medicine.

Exercise.—Still if proper exercise is taken all the different functions of the body generally go on regularly and well. Daily exercise of the

whole body is a necessity for every one, men, and women and children alike, if they wish to have good health. A healthy mind in a healthy body is what we should all try to have, and only those who exercise the mind by study, and the body by using their muscles can have this. Exercise is especially necessary for young people because it hardens their muscles and makes them grow bigger, but it is also necessary all through life, to keep the skin and the bowels and all parts of the body acting properly.

Effect of exercise on the body.—The Liver.—When exercise is taken more waste matters are poured out from the body—the heart beats quicker, and the blood flows through the lungs quicker, getting rid of more carbonic acid—we breathe more quickly and the muscles of our chest become stronger—more blood is sent to the skin, and more perspiration got rid of—more bile is squeezed out of the liver, and more waste matters are both poured into, and got rid of by the blood in every part of us. But when people lie or sit still the greater part of the day, the circulation of the blood in the interior of the body, and especially in the liver, becomes sluggish and weak, the heart and lungs both work slowly, and waste matters accumulate everywhere, and make people feel lazy, and unable to move about, or do anything quickly. When people feel weak, dull, or melancholy, it is far oftener because they want more exercise than because they want more food. One can never get a fire to burn well without first clearing away the waste and the ashes from the fire that has

just gone out, and in the same way food cannot nourish people if the body is all choked up with waste matters, from the meal before.

Various exercises.—Running, walking, and playing are all good ways of taking exercise, especially for little children, and if children are well and strong they are generally fond of playing and moving about just the same as puppies and kittens and little kids are. All young things play if left to themselves, and it is this playing which strengthens their muscles, and makes them grow larger and stronger.

Running.—Running is a good thing for older boys and girls, if they run without tiring themselves too much, and without getting too much out of breath. If they go either too far, or too fast, they may injure both their lungs and their heart, unless they practise little by little and train themselves to go farther and faster gradually.

Walking.—Swimming.—Walking and running are both excellent ways of training the heart and lungs, and so also are cricket, tennis and all such games; but the best of all exercises is swimming, wherever there is a place to practise it, as it not only strengthens the heart and lungs but nearly every muscle in the body.

Gymnastics.—Apart from games and ordinary exercises however, gymnastics are excellent to develop the body and keep it in health. Gymnastics, that is systematic exercises beginning with easy ones, and gradually getting more difficult, not only educate the body as lessons do the mind, but they can cure it of

certain diseases if properly employed. For instance, a narrow chest and stooping back can be cured, and both the heart and lungs will be the stronger for it ;—in the same way indigestion and biliousness are sometimes cured either by gymnastics or horse exercise. No precautions in food and drink, and no medicine, it must be remembered can keep the liver and bowels in order without exercise.

Light and heavy gymnastics.—Now gymnastics are of two kinds, called light and heavy. Light gymnastics mean exercises done with light dumb-bells, Indian clubs, rods, balls, &c., and are suitable for girls or little boys—and heavy gymnastics are exercises on parallel and horizontal bars, pulling or lifting heavy weights and so forth, and they are only suitable for men or for boys who have gradually worked up to them.

Object of exercise.—All exercise is good so long as it *trains*, and does not *strain* the muscles or any part of the body, and so long as it is taken before, or between meals, and never immediately after—whilst regular and sufficient exercise, with the physical discipline of the body, is one of the best things to give a healthy tone to the mind, and to make children and grown-up people recognise the necessity of law and order in daily life.

Sleep and exercise.—Sleeplessness.—It is also one of the best means of securing healthy and sound sleep. Sleeplessness is more often caused by bad digestion, or the want of being tired than anything else, and when it is from this

cause it is no use taking opium or similar things. The only permanent cure is either plenty of hard physical work, or proper exercise. Sometimes people cannot sleep because they go to bed just after a heavy meal, or because they lie on their left instead of their right side, and thus press the heart instead of the liver, which is much better—or again because there is no fresh air in the room, and they are breathing the same air over and over again and so get a bad headache. No one can fall asleep until nearly all the blood in the brain has left it, so it is not a good thing to work the brain much before going to bed. Whilst any one is thinking or studying hard, the brain is very full of blood, and generally if anyone is working for an examination their head is so full of their work that they think about what they have been reading or studying after they go to bed, and that of course prevents the brain becoming calm enough for sleep. Strong tea and coffee, like small doses of opium, belladonna, or Indian hemp (*hashing bhang*) all increase the circulation of blood in the brain, and by making it more active, prevent sleep, so that they are all bad to take just before going to bed. Night is the natural time for sleep, and those who find they cannot sleep well at night should remember this, and two things besides: Never to go to sleep in the day, and to take plenty of exercise.

Amount of sleep.—The amount of sleep every one takes is generally a matter of chance or habit, but although children require a great deal, grown-up people are healthier and stronger if

they only sleep 7 or 8 hours out of the 24. No one, unless they are ill, should allow themselves more.

Clothing.—Head and abdomen.—As regards clothing, which is another matter of purely personal care, the chief thing is to clothe the head and the abdomen well. They are the two most sensitive parts of our body. The head is most affected by heat, and the abdomen by cold and chills, and to those who want to keep strong,—sensible clothes are as important as clean clothes. Men's and boy's heads are generally enough protected by their *pugaris*, but women are often badly off, and if they go out when the sun is very hot, they should have a good thick umbrella of white cloth, pith, or leaves.

Flannel kummerbunds.—Men, women and children alike, should always wear flannel wound round their stomachs at night. It is the best thing to prevent chills, especially in the cold weather in Northern India, or in the monsoon, or when the seasons are changing or in the hot weather under the *punkha*. Flannel clothing is better than cotton, because flannel or woollen stuffs absorb the perspiration, whereas cotton soon gets wet through, and becomes cold and damp next the skin.

Changing clothes.—Of course clean clothes should never be put on unless thoroughly dry, and if anyone gets wet through, all the clothes should be changed at once. Flannel worn round the abdomen keeps the liver and kidneys especially, in good order, besides helping the skin

to act better all over the body. At the same time no flannel or belt should be bound so tightly round the body as to press the lower ribs, particularly if exercise is being taken,—and after exercise it is always a good thing either to change all the clothes which have become wet with perspiration during the exercise, or to put on a thick coat or wrap.

Woollen clothing.—Directly exercise is finished, the skin begins to cool down, and then if perspiration is suddenly stopped by a cold wind blowing on anyone, rheumatism, or some kind of inflammation of the lungs, or other organs may result. During exercise we need light clothing; after exercise dry, warm and especially woollen clothing. Woollen clothing is good, not only because it absorbs perspiration, but also because it is a bad conductor of heat.

Wearing flannel or wool next the skin is most necessary in malarial places, because by preventing chills it makes people less liable to recurring attacks of malaria.

Colour.—For keeping out heat the colour and not the material is the chief thing to think about. White is the best; next grey, yellow, pink, blue, and lastly black; so that in hot countries white or light-grey clothing is the best.

Care of Children.—Food for a baby.—Bad food for a baby.—Of course it is possible for grown-up people to take care of their own health. Children and babies cannot do so, and yet it is just as important for them to be healthy and strong. When we think that a baby may live

for sixty or seventy years we must see how unkind it is to allow it to lose its health in any way; either by giving it improper food, or shutting it up in close, badly-smelling rooms or clothing it wrongly. Everything that has been learnt about keeping a house and its surroundings clean; about washing and bathing the skin, and having plenty of fresh air and exercise, is very important to remember wherever there is a baby. The only food a baby should have until it begins to teeth, and the saliva begins to flow, is milk. Milk, as we know, is a perfect food and has everything our body wants to make it grow and get strong—and as a matter of fact it is cruel to give a baby anything but milk or patent milk-food for the first six months, because it cannot digest any other kind of food. If it has rice, or a piece of *chapatti*, or a little meat given to it, it has no saliva in its mouth to turn the starch of the rice or *chapatti* into sugar—neither has its little stomach the power to break up and digest the solid part of meat. So that even if such food does not give a strong or healthy child indigestion, it simply passes out of the body without giving any nourishment.

A baby should never be allowed to eat or drink too quickly, or to suck an empty bottle, as any of these things may give it wind.

Clothing for a baby.—The eyes.—Besides having good food, a baby ought to have clean, loose clothing, a flannel band round its body, and its head protected from the heat of the sun. It should have a bath every day, and never have its eyes smeared with *ghee* or other grease,

because though *ghee* may do no harm in itself, yet it attracts flies and other insects to settle on the child's eyes, and the contagion from leprous sores, or from other children's bad eyes, as well as the contagion of other complaints may be carried in this manner.

Age to marry.—Children, as they grow up, should all be taught to take care of their own health, and girls should never be allowed to marry until they are full-grown. If they become mothers before they have stopped growing, that is between 15 or 16, *at the earliest,* they cannot have healthy, strong children, and their own health will become weaker as well. It would be more sensible, however, not to marry until, at least, 18 as they do in Europe.

Way to become a strong race.—If the people of India wish to become strong, they must all obey the laws of health, and remember that—"Prevention is better than cure."

CHAPTER VII.

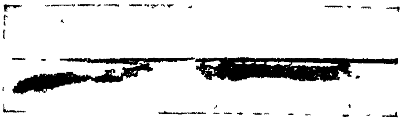
The Prevention of Disease.

DISEASES AND THEIR CARRIERS—MALARIA AND MOSQUITOES—PLAGUE AND FLEAS—CONSUMPTION—ENTERIC FEVER—CHOLERA—DYSENTERY AND DIARRHŒA—DIPHTHERIA—SMALL-POX—MALTA FEVER—KALA AZAR—SANDFLY FEVERS—RINGWORM—LEPROSY.

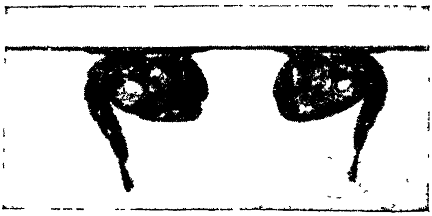
One very important thing all of us have to do is to try and prevent disease not only in ourselves but in others, and so we have to learn how diseases are spread.

The chief diseases we have to fight against are only too well known. They are Malaria, Plague—Tuberculosis or Consumption, Typhoid or Enteric Fever, Cholera, Dysentery, Diarrhœa, Diphtheria, Small-pox, Malta Fever and Kala Azar.

All of these come from germs or microbes, minute organisms which cannot be seen without the aid of a powerful microscope. Therein lies their danger—they are Hidden Enemies, and it is far more difficult to fight an enemy we cannot see than one that is always showing himself. Now how do these Hidden Enemies get into our blood and bodies? Some of them come through mosquitoes, flies, fleas, bugs and other kinds of insects. Sometimes the germs are hidden in their very innermost bodies and are



1 Larva of Anopheline Mosquito in the water.



2 Pupa of Anopheline Mosquito in the water

3 Anopheline Mosquito at rest

Culicine Mosquito at rest.

injected into us as if with a syringe—at other times they are hidden under the legs or wings of the insects and so deposited on our food or in our water when they alight. Scientific men have discovered after months and years of patient study and research that nearly every disease has its special carrier—for instance, malaria is carried by mosquitoes and plague by fleas, three and five-day fevers by sandflies, anthrax and blood-poisoning by biting flies, sleeping sickness by the Tsetse fly, acne by the face mite, kala azar by the bug and relapsing fever by lice.

Malarial Fever.—Here in India we are all well acquainted with malarial fever or ague and its varieties—they are all caused by micro-organisms in the blood, and these minute parasites are introduced into our blood through the proboscis of the anopheline variety of the mosquito. This insect, however, before it can introduce poison into us must already have fed on malarial parasites contained in the blood of someone else. A bite from another kind of mosquito or even from this kind will not bring on fever, unless it has previously bitten an infected person. As the elaborately constructed proboscis or beak of the insect pierces the skin the parasites are injected into our blood, and at the end of a week or ten days the fever of which they are the cause appears.

Directly they are introduced each separate parasite enters one of the red blood cells and lives and grows in it. When full grown each parasite divides and produces a number of spores which escape from their original cell and

enter fresh cells. Thus it is that although only a few parasites are injected by the mosquito they increase so rapidly that millions of them may be living on their victim.

At first when the number of parasites is still small a person may be apparently well but when the number increases ague is the result, and this passes on to fever which after 6 to 40 hours, owing to the poison being eliminated from the body, disappears. In the meantime another generation of spores is coming to maturity and so a fresh attack of fever occurs. In this way you get fever occurring at regular intervals.

There are at least three varieties of the malarial parasite which can be distinguished from one another under the microscope.

(*a*) A parasite that produces its spores every three days and causes what is known as quartan fever.

(*b*) A parasite which produces its spores every other day and is known as tertian fever.

(*c*) Parasites which cause malignant and pernicious fevers, they are malignant in type, and it is in them that dangerous complications frequently occur.

A large number of persons especially children harbour malarial parasites in their blood without shewing signs of malaria thus acting as latent reservoirs or unsuspected carriers; these are generally in the indigenous population of the district; and although they do not suffer from fever they probably have enlarged spleens and are able to infect the mosquito, with the result that newcomers are struck down as if by magic.

We know there is one way of killing these parasites in the blood ; this is done by giving quinine in sufficient doses and at regular intervals. It must be continued for months as so long as a single parasite remains alive in the body relapses may be expected. At least 3 grains of the drug should be taken daily at even time for 4 months to prevent a recurrence.

It is possible to escape having malarial fever altogether if we take certain precautions.

We can save ourselves from being bitten by sleeping under mosquito nets and screening doors and windows with wire gauze—the nets should have not less than 5 holes to the square inch and the wire gauze 18 meshes. We can prevent the mosquitoes living and propagating by encouraging their natural enemies, fish, small birds, dragon flies and water insects, and by doing away with all hollows and damp places which retain stagnating water near our homes.

It is the female and not the male anopheline mosquito that is the cause of the malarial infection and it prefers to breed in small collections of water as small pools in the earth or lined with earth at the margins of lakes and slow running streams and tanks and any odd receptacles lined with mould. All these should be watched and filled in if possible or drained or treated with oil—if kerosine oil mixed with chloride of lime is poured on the water in which mosquitoes are breeding so as to form a very thin film on the surface the larvæ are unable to breathe through it and are suffocated. Bath, cook-house and pantry water should not be allowed to collect in

pools and the receptacles containing it should be thoroughly emptied out frequently. Irrigation cuts should, if possible, be of masonry, or if not, they should be carefully kept clear of weeds and water not allowed to stand in them in pools. All wells should be fitted with insect proof covers, and if possible the water should be drawn out by pumps. Kerosine and lime should be floated weekly on to open tanks in which mosquitoes are breeding.

Many people in India complain that the introduction of so much irrigation into many districts has very materially increased the amount of malarial fever. This is true in a way but there is no necessity to allow the anopheline to breed now we know its habits—and remember if we abolish this insect we abolish malaria. It is certainly a fight worth taking in hand. Irrigation if carefully carried out ensures good and proper cultivation of the land and diminishes breeding places.

Tobacco which requires much water can be cultivated with impunity if the water is not allowed to stagnate in pools around the plants, in fact the best can only be grown where such a precaution is taken.

Bamboos when cut down leave hollow stumps which when filled with rain water provide excellent breeding places for the mosquito, so too do flower-pot saucers and even cut flower glasses, if not frequently emptied and properly cleaned. Puddles made in the mud near tanks and wells by cattle should be levelled over and the animals watered from troughs and buckets.

Mosquitoes may be removed from houses by burning pyrethrum powder or still better dried *neem* leaves in the rooms, but as they are mostly only stunned they must be swept up afterwards and burnt. Perhaps the best thing to use is a mixture in equal parts of carbolic acid crystals and camphor dissolved by gentle heat in the proportion of four ounces to 1,000 cubic feet for the space of two hours. It does not injure furniture, metal work or wall paper, and besides leaving a pleasant refreshing smell, kills moths and other vermin.

Just as malaria is due to the bite of the anopheline, so the yellow fever of America is due to the bite of another mosquito when infected previously by man called Stegomyia; but this prefers to live in drinking water and is not an earth-pool breeder. Fortunately this disease is not known in India.

Plague is due to a bacillus, a micro-organism which can have no life outside an animal body, and it is spread ordinarily by rats to man through the particular kind of flea infesting them. It must be remembered, however, that there are some kinds of plague which can be passed directly from man to man, and though these are not common in India, yet as being very infectious the possibility of contracting the disease in this way must also be borne in mind.

Rat fleas suck in the plague bacillus with the infected blood of the rat, the bacilli multiply in the body of the flea, and when the flea again bites a rat or a human being it passes on the infection.

The fleas lay their eggs in the nests of the rats, the warmth of the bodies of these animals hatches them out, and then they supply them with food and conveyance from place to place. When the rats die or desert their nests the fleas deprived of their usual food supply will bite human beings, although ordinarily they would avoid doing so.

Plague by means of rat fleas is usually conveyed from place to place by people on their bodies or in their baggage or in goods whilst the human agent frequently escapes. To fight plague therefore and to cut it off from its source, we must make war on the rats and rat fleas, and so to conquer plague we must have in all Indian towns and villages :—

(*a*) Such clean well built houses that there will be no shelter for rats to build their nests in so that the house is rat free and rat proof.

(*b*) Houses where there are no pieces of food left about or grain left loose which would attract rats.

In Europe we look upon the rat as one of man's greatest enemies, and so he does not thrive about the house. Here in India he is fed and encouraged, but now that people know how dangerous he is in spreading such a terrible disease, perhaps they will not be so kind to him.

To show how important it is to have houses with no cracked walls and holes for rats to breed in one may point to the conditions found in Eastern Bengal where there is a comparative scarcity of rats. A striking characteristic of the

inhabitant of this part of India is his neatness and tidiness compared with those of the inhabitants of other parts of India, not only in his person but in his house and surroundings. One seldom sees rubbish littered about and around houses, nothing unnecessary is left on the floor, their houses are better built and there is no harbourage for rats. Very instructive photographs have recently been published of clean and orderly Purneah and Puradah, two villages in Lower Bengal, free from plague, and Bhagalpur, all mud walls and rat holes, plague infected. Plague is truly a vermin and dirt disease, and cleanliness is one of its worst foes. It should be remembered that all vermin dislike the light and sun, and so it is most necessary we should have no dark corners in our houses, and that it should be possible to let both of these natural disinfectors into all parts of them. Fleas can be killed by the application of a soap emulsion of kerosine oil to the floors and walls of rooms, and when they are present in cloths, grain or goods by having these separately and thoroughly spread out and exposed to the sun for several hours.

It is most important to remember that when we are living in the midst of plague we can obtain almost sure protection against it by being inoculated for it by Haffkine's serum. This is made in such a way as to be in every sense pure and so free from anything that would injure health or affect caste.

Consumption.—One of the most dreaded diseases is consumption which is the name by

which people generally know what doctors call phthisis, tubercle or tuberculous disease. Consumption is due to a special bacillus or germ, and it must be fought not only for the sake of ourselves but for the sake of others and for our children. This micro-organism cannot move of itself but is very easily carried in dirt and dust, and is likely to be found in all dark and insanitary places. A consumptive person is not in himself so dangerous, the danger lies in his spittle or sputum, and for this reason consumption spreads rapidly where people have dirty habits and spit about the floors either in their own homes or in railway carriages, tram-cars and in all public places.

A consumptive should invariably spit into a vessel containing a disinfectant—1 in 20 carbolic acid, or cresol solution 2 teaspoonfuls to a pint of water, and the spittle must be afterwards buried or burnt, so that it does not become a source of danger to and infect other people.

If he is in a public place he can spit into pieces of paper which can afterwards be burnt by him, but he must in every case remember that the spittle must not be left on the ground to cause contamination and lead to the spread of the disease. It is remarkable that consumption is very fatal in India, and is especially prevalent amongst Mahomedan women who are shut up in purdah and crowded together in dark, ill-ventilated and sunless rooms.

Mahomedan women die at the rate of 5·8 per 1,000, whilst Hindu women only at the rate

of 3 per 1,000 from this disease. In Calcutta the death rate is 2·5 per 1,000, whilst in England it is 1·9 per 1,000 and, is increasing in the one but decreasing in the other. Overcrowding and constantly breathing air fouled by animals and human beings, as well as the dirty cracked mud floors of Indian houses are responsible for this. The practice of leeping with cow-dung also helps to spread it, as the dung may be full of tubercle bacilli from the cow. Cows in common with some other animals suffer from consumption. For this reason the disease is spread by the drinking of the milk of cows suffering from it : so that it is always wise to boil all milk. And one should be careful at the same time where the butter supply comes from and that it is always kept carefully covered up. Once the milk is boiled, it must be carefully screened either in clean bottles stoppered with cotton, wool or in wire-gauze-protected safes, as it is more liable to be affected by germs dangerous to life introduced by flies than raw milk. Boiling destroys the lactic acid bacilli, which, though by its growth, causes milk to sour, also tends to destroy harmful germs, and so you may have what appears to be quite good milk, and yet which is very full of micro-organisms.

Here again insects play a deadly part in disseminating disease and the homely, innocent looking house-fly is one of the worst sinners in this respect. Flies do not actually suffer from consumption, but the danger is that once a fly has fed upon anything that has come from a tuberculous patient the bacilli multiply very

rapidly in the digestive tract of the fly. The house-fly as we know flits hither and thither over our food stuffs, it may be dropping bacilli in our milk or on our sugar as it takes toll of them wherever it goes, and so perhaps infects some members of the household. It is not a pleasant idea to think of and shows the necessity for covering all our food supplies, in the cook-house or milk or meat safes as on the table. Gauze wire meat safes should be used to keep food in, and on the table itself small pieces of clean muslin with weights at the corners, (metal buttons will do), or where the flies are very bad, metal and gauze dish covers.

Open Windows.—To prevent consumption we must not only remember to refrain from the dirty habit of spitting and to keep houses and rooms free from dust and dirt, to boil all milk and to keep flies off our food but we must let plenty of sunlight and fresh air into our houses night and day and not sleep with our doors and windows shut—air which has not been used up by animals and men is one of our main safeguards against consumption as it keeps our vitality at its highest point and besides helps us to fight all other diseases and to do our best work mental and physical.

Enteric or Typhoid Fever is due to a micro-organism or bacillus which causes a blood poisoning or septicæmia. It was formerly supposed to be purely a disease of the bowels, but it is now known to be essentially a dirt disease. The infection comes directly through our food or drink, which has become contaminated by the

excreta of some other person suffering from the disease. We can protect ourselves mainly in two ways—individually and generally. Individually by inoculation, and generally by care in keeping off flies both from our food and supplies and from providing them with breeding places in refuse and dirt around our dwellings and by careful attention to the purity of water and milk we consume.

Inoculation is undoubtedly a great protective as now practised, and its benefits last for from one to two years. It is quite harmless and causes but slight indisposition for some 24 to 48 hours after the first injection and for half-a-day or so the second time; an interval of 8 or 10 days is generally allowed between the two injections. The material used is called a vaccine. It is made by growing the typhoid bacillus on mutton broth, the bacillus is then killed by heat and after lysol has been applied to give it keeping qualities it is ready for use. This protective agent has now been in use in the Army for some years, and it has resulted in a great reduction in the liablility to contract the disease as well as in the death-rate.

For general prevention we must remember that the disease is chiefly spread by water or milk contaminated with the typhoid bacillus from the excreta of persons suffering from the disease, but also from others who though no longer ill from the disease, still carry the bacillus about with them. It has happened that these so-called typhoid carriers have unknowingly been employed as cooks or as bakers or even in

dairies and apparently mysterious outbreaks of the disease have occurred in consequence.

Typhoid fever can be stamped out entirely in time if every one will help. Our Health Officers should be responsible for seeing that every town and village has (*a*) a pure water supply, (*b*) a food supply free from the contamination of infectious fevers, (*c*) means for the proper disposal of excreta, (*d*) the isolation of all persons who act as "carriers" of the disease.

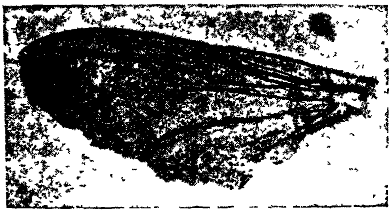
Fortunately the life of the typhoid bacillus is a short one outside the human body and fresh supplies are only forthcoming with new cases of the fever: so that if all cases suffering from it are so carefully dealt with that all germs coming from them whether in the urine or in the fæces are disinfected and burnt, and that all persons are kept in Hospital or under observation until they are free from the bacillus, we shall put an end to the disease.

The special points we have to consider in domestic hygiene are cleanliness around our dwellings and the protection of our food supplies once they are under our control. Where possible it is better to have self-closing wire or gauze doors to the kitchen, meat and milk safes, and to do all that lies in our power to keep out dust and flies.

Flies as we now know, are one of our most dangerous enemies in carrying about bacilli—one scientific man recently proposed calling the house-fly the "typhoid" fly, but considering that it is equally responsible for carrying cholera,

THE HOUSE FLY.

Magnified foot of house fly shewing rough surface to which thousands of germs may adhere



Magnified scales of wing of fly shewing dirt adhering

tuberculosis and other diseases, some prefer to call it the "septic" fly. The fly is essentially a filth eater, and wherever there is any vegetable or animal matter decaying or fermenting, there the fly will feed. It especially fancies human excreta, and this, whether from healthy or unhealthy persons should be so effectually disposed of that no flies can feed on them and carry any germs in them on to our food. If there are flies in our house, it means there is filth close at hand and that there is danger in that filth, and that it should be got rid of or the fly will take it up on its wings or legs and afterwards deposit it upon our milk or on our sugar or meat or other food stuff and so give us some deadly disease.

Cholera, Dysentery and Diarrhœa are spread in much the same way as enteric fever. They are all due to special germs, very virulent, deadly ones, as we know but they can be conquered and kept under. Flies play their usual part in helping to disseminate them, but water and milk must also be increasingly guarded. There is no doubt that with the introduction of pipe borne water cholera has practically vanished from places in which it used to be rife. Old wells and wells likely to be contaminated should be avoided for drinking water, and if the water from them is used for bathing purposes it is as well to protect young children from the possibility of drinking it unboiled unawares. Where cholera is prevalent people should avoid eating uncooked vegetables or unripe or over-ripe fruits, and should avoid chills, especially in connection with the abdomen.

We can also be inoculated against cholera with a vaccine which causes very little indisposition and affords us protection which lasts for about fourteen months. Wherever cases are treated at home the most rigid disinfection of all stools should be carried out, and great cleanliness is necessary in the hands and person of any one attending a case. Unfortunately cholera like typhoid fever has its unconscious carriers who are apparently in perfect health.

Diphtheria.—A very rapid and fatal disease of the throat is due to a micro-organism, which thrives where there is carelessness in the disposal of excreta or any filth nuisance. It may be contracted direct from another person or animal or from infected milk. If a case is at once injected with diphtheria anti-toxin the disease is usually arrested, but otherwise it is a very fatal complaint. It is very highly infectious and people who are nursing cases should certainly be inoculated and should be most careful not only to disinfect everything coming from the patient at the time, but when the attack is over to disinfect all bedding, carpets, furniture and clothing to prevent the disease spreading.

In **Small-pox** we have to deal with a justly dreaded scourge which is wide spread amongst all races and in all climates. The fact that it is due to an unknown microbe does not concern us, everyone knows that it is the most contagious, infectious and loathsome disease. Luckily thanks to the genius of a great English Doctor, named Jenner, we have a very safe method of protection in vaccination. This if

properly carried out in infancy with 3 or 4 good marks and again after 10 years of age, generally protects people throughout life. In India the buffalo calf is used to provide the vaccine, which after being disinfected and given keeping qualities is sent out in a very pure state from centres to all parts of the country. The greatest thing to fear is that forgetting the way in which vaccination has stamped out the disease in many places in the past we may forget the necessity of it, and so let the disease gain fresh way with all its old virulence. Directly a case occurs the sanitary authorities must be informed through the Chowkidar or Headman of the quarter of the town or village. During the attack the patient must be absolutely isolated from all except the one or two persons actually doing the nursing and after the case is no longer infectious, the most rigorous disinfection must be carried out. Things that have been used in contact with the patient should, as far as possible be burnt. All persons who have, it is known, been in contact with the case at any time since he contracted the disease together with his attendants should be vaccinated as quickly as possible after the character of the complaint is known.

Malta Fever—a very weakening and wide spread disease occurring in India as well as in other countries, has fortunately been brought under control owing to the discovery of its being due to a minute organism, which gains admission into our bodies through drinking the milk of goats infected by it. This source of

infection was suspected and was finally proved in 1905 by a steamer sailing to America shipping nearly 100 goats from Malta. The Captain and all those who drank the milk on board suffered from the disease. In Malta and Gibraltar, where the disease was very common, it has been abolished from amongst the troops by removing the goats or by stopping the milk.

This disease affords one more proof of the necessity of guarding against infection through our domestic animals. Just as we get Malta fever through the goat, and tubercle through the cow, so we may get anthrax or glanders through the horse, rabies or worms from dogs and diphtheria through cats, and the dog and the cat are most to be feared as they wander about in dirty and unknown places.

Kala-Azar—is a disease mostly met with in Eastern Bengal and Assam. The micro-organism that causes it is also found to be present in the different kinds of Oriental sore, Delhi, Lahore, etc. The infection is by the bed-bug, and so here again we find cleanliness absolutely essential to good health. Bedsteads must be kept quite clean and they should be so constructed that no hidden spaces are left into which these insects can creep and live and breed. The exposure of beds to the sun with a liberal use of kerosine or cocoanut oil to all parts will help to get rid of them or fumigation in a closed room by means of sulphur fumes.

Sandfly fevers.—Which are short attacks of fever without any apparent cause lasting from 3 to 5 days are due to the sandfly found in

all parts of India. The ordinary mosquito net will not keep them out, and so where they are very numerous and where especially very young children are concerned, *mulmul* or *abi-rawan* curtains are necessary as a protection, or they can be destroyed by fumigating our rooms by means of fumes of camphor and crystallized carbolic acid given off by gentle heat.

In **Ringworm** we have a complaint which is very unsightly and contagious though not in the least dangerous. Like Dhobie's itch to which it is akin, it is due to a fungus or parasite. Everything touching the disease area is likely to convey contagion, so persons suffering from these diseases must take great care that all articles, such as towels, brushes and clothes used by them, are not touched by others and are destroyed or thoroughly disinfected after use.

Leprosy is well known in India, but it was also well known in England once upon a time. It has, however, been overcome by the good sense of the people who recognised that the only way to rid themselves of it was to separate the healthy from the unhealthy. We should do our best to see that this is done in India, but in doing so it is our duty we must remember to take every care possible of the poor people suffering from this terrible disease, giving them comfortable buildings to live in, and plenty of food and good clothing. Owing to the fact that the disease is probably mostly spread through the discharges from their open sores, these should be always kept covered with

antiseptic dressings which should be frequently changed and burnt after use. As in tuberculous disease, which leprosy is very like in many ways, the sufferers must be given plenty of fresh air and protected against flies. They must never be allowed to have anything to do with the supply or preparation of food.

SECTION III.

NURSING.

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CHAPTER I.

REQUISITES OF GOOD NURSING—CHOICE OF ROOM—BED AND BEDDING—CLEANLINESS—FURNITURE IN SICK ROOM—VENTILATION.

We have now learnt how to do the best in every way to prevent ourselves getting ill; but unfortunately until everybody knows how to preserve their own health, and try their utmost to do so, we shall none of us be able to escape illness entirely.

Good nursing.—All require good doctoring; but if the patient is to recover, they also require much more, that is, they require good nursing.

Good nursing means many things; it means:—

(1) Keeping the sick-room clean and fresh, and the right temperature.
(2) Making the bed comfortably.
(3) Making poultices, fomentations and various applications properly.
(4) Giving the medicine and food at the proper times.
(5) Washing and dressing the patient carefully.

(6) Noticing things to tell the doctor.
(7) Using disinfectants.
(8) Doing everything generally to save the patient being uncomfortable or worried.

Choice of room.—The first thing we have to do when any one gets ill in a house, is to choose a room for the sick person to be in, and then to take everything out of it except what is really wanted. Most people when they get ill are generally put into their own bed-room, but this is not always the best room for getting well in, and a better one may perhaps be chosen.

A good room.—The room in infectious cases.—A good room is a large one, which is not near a noisy road or servants' houses—which is quite dry, with no smell of damp about it—which has a fire-place in it,—windows, or ventilators opening out above the verandah—where there is light and coolness, but no heat or glare—and where the sun will not beat on it all day long. If the patient has an infectious illness, a room as far away as possible from the rooms where the rest of the family live, is necessary; but a sick person should never be put into a room that is seldom or never used, unless all the doors and windows are first thrown open to let in the fresh air—and unless, if it is in the rainy or cold season, a fire is also lighted in it for 24 hours or more.

Cleanliness of room.—Besides this, the room must be thoroughly swept and cleaned in every corner—and if there is only one large *durrie*, that should be taken away, and two smaller ones put, one on each side of the bed. The

small *durries* can be taken out of the room every day and well shaken, but a large one with the bed standing on it cannot be cleaned at all.

The bed.—The best kind of bed for a sick person is an iron one about 3½ feet wide with a wire mattress; but if this cannot be had, and the patient is obliged to have a native bed, let it be new, or at least very clean *newar*, and not too wide for the nurse to be able to reach across it easily. The Indian custom of having the bed in the middle of the room is a very good one, because the nurse can attend to the patient from either side, so in illness there is no need to alter this position.

Cleanliness in everything.—Cleanliness is one of the chief things in a sick-room, and therefore we must not only begin by having everything clean, but go on keeping all clean.

Bed-clothes.—The bed itself must be perfectly clean, and the sheets and blankets equally so. An old *rezai* which has been used a long while to sleep on, is a very bad thing, because it is soaked with perspiration, and cannot smell sweet and clean. If *rezais* are used, there should be two, one for the night and one for the day, so that they can be put in the sun to air by turns. But cotton sheets and new blankets are the best because they are both warm and light. Sick people generally cannot bear anything heavy on them, but they may want to be kept warm.

Airing the bed.—It is always a good plan to have a number of clean things for the bed, and to hang everything out in the sun, or, in the

rains, before a fire, as often as can be—for when anyone is ill the perspiration coming from their skin is very unwholesome.

Perspiration.—Waterproof sheets.—We know that perspiration is waste matter, and that it is always passing from our skins ; so, if the patient is not constantly provided with clean clothes and bedding, the perspiration never really leaves his body, but soaks into all he lies on, and makes him much longer in getting well. Perspiration in the bed-clothes will make a room smell badly, even if everything else is kept clean. Another thing to be careful about, as regards keeping the bed and bedding clean, is to have a sheet of waterproof under the sheet, whenever there is any discharge of blood or matter coming away from the patient.

This, if smoothly laid in the proper place, will prevent anything soaking into the bed itself. If, however, either through carelessness or accident, a part of the mattress, or the *newar* becomes soiled, it must be removed at once, and either a fresh mattress or new bed put in its place, the old one not being used by anyone until thoroughly cleaned.

Discharges in illness.—It must be remembered that all discharges coming from a sick person decompose or go bad very quickly, and if left near the patient, will either make a disease worse, or add to it another more severe and dangerous.

Still another point to pay attention to is to make the bed well, and to put the pillows comfortably.

Making the bed.—If the sheet gets 'rucked,' it is not only very uncomfortable but it may cause a bed-sore : but, if it is laid on perfectly, evenly and smoothly, and tucked in securely or pinned fast with safety pins, the patient can sleep and rest in comfort. Every good nurse will also see that the night-dress is pulled down smoothly, and that there are no crumbs or pieces of grit either in the bed or sticking to the back of the night-dress.

Air and Water-Beds.—Sometimes in order to prevent bed-sores air or water-beds are used. The air-bed is laid on the top of an ordinary mattress ; it must not be filled too full or it will be hard and uncomfortable, it is best to have two under-blankets over it ; and the bed is then made up in the usual way. A water-bed must first be put into position on the bedstead and then filled with water at a temperature of 90°F., care again being taken not to fill it too full. It can easily be tested by lying on it yourself first. It is as well to remember not to stick pins into these beds.

Changing sheets.—When a patient is too ill to be moved out of bed, the sheets must be changed frequently. This is how it is done :—The bed clothing is loosened all round the bed, and a clean sheet well aired is rolled up length-wise to half width—the patient is first turned gently over on to the side furthest from the nurse, and the under sheet rolled lengthwise towards him, whilst at the same time the roll of the clean sheet is put close up to it and spread carefully out into its proper position

—the patient is then turned gently back over the two rolls of sheets until he lies entirely on the clean sheet. The nurse moves over to the other side of the bed ; she now pulls the soiled sheet away and the clean one into position, taking care that no rucks or creases are left. If the top sheet is also to be changed—this is laid with one of the blankets over the other clothes, and while it is firmly held in position, at the top by an assistant each side of the bed, the other clothes with the soiled sheet are drawn away underneath, the necessary blankets being replaced afterwards.

Both sheets can be removed without uncovering the patient and with very little disturbance after a little practice.

Sometimes both a draw-sheet and a waterproof are required to keep the patient and bedding clean. In these cases a strip of waterproof three feet wide is put underneath the draw-sheet right across the bed under the patients' hips, or elsewhere, as required. The draw-sheet is a folded piece of sheeting laid across the bed, which can be drawn through from time to time to give the patient a cool and clean portion to lie upon. As it is drawn through, it is folded in and pinned down to the under sheet.

Furniture of sick-room.—Neatness and tidiness again are as necessary in a sick-room as cleanliness ; and for this reason it is better to have only a few pieces of furniture in the room, just those which are really needed.

These should be dusted once or twice daily with a duster damped in some disinfectant to

prevent dust, and with it any infectious germs, being scattered about. It is no use flicking round with a duster, as the dust is not removed, but immediately settles in another place. If the floor requires sweeping, wet saw-dust or tea leaves should be sprinkled on it and swept up with the dust.

(1) Two strong tables, one for putting anything on, and another close up to the bed, where the patient may be able to reach things.

(2) Two or three chairs, so that neither the doctor nor the nurse need sit on the patient's bed.

(3) A sofa or arm-chair for the convalescent stage.

(4) A chest-of-drawers or almirah.

(5) A washstand.

The commode or bed-pan is a piece of furniture which should only be brought in when wanted, and taken out directly after to be emptied. It should be washed out both with soap and water and disinfectants (see page 197) so that it is kept scrupulously clean. One with varnished or polished wood-work is the best to have, because plain wood absorbs dirt and smell.

A room with only these things in it will, of course, look very bare; but there is no harm in adding a little decoration where the patient is fond of pretty things.

Woollen curtains.—It is not a good thing to have woollen curtains or *purdahs* up, because they collect dust, dirt and infection, and soon get to smell dirty in a sick-room; but muslin

or cotton curtains or *purdahs* may be put up and will make the room look nice.

Pictures.—Pictures, too, may be hung up ; but flowers, if they are brought into the room, should not be left more than a few hours, and only fresh ones in fresh water should be allowed.

Ventilation.—Besides keeping the sick-room neat and tidy and clean, there is one other thing that is more important than all ; and that is, to keep it well ventilated, constantly full of fresh cool air. The air in a sick-room should be kept as fresh and free from moisture as the air out of doors ; and if when one goes into a sick-room, one notices that it smells, or is stuffy, it shows there is not enough ventilation. We have learnt that if there is not good ventilation, the air in a room gets slowly poisoned : so, in a sick-room if the air is not kept moving, it slowly poisons the poor patient who has to breathe it, and is bad also for those in attendance.

Effects of bad air on babies and their mothers.—It is this poison that kills so many Indian women and their little babies, because it is the custom, when a child is born, to shut the poor mother up in a room where not even a door is open ; and then for lots of neighbours and friends to crowd in. Some people say, when babies or their mothers die, that "Fate has killed them ;" but doctors know better : they know it is poisoned air, or dirty surroundings and dirty attendants. All of those who understand the laws of health must see how cruel this custom is, and that one might as well give a mother and

her baby poison to drink, as give them only poisoned air to breathe into their lungs.

The only way to get enough fresh air is always to keep at least one window wide open, never to shut it night or day—for, remember, people cannot easily catch cold in bed unless they are in a thorough draught. And if there is not a window in the room, but only a door, as is often the case where Indian women live, then be sure that it is always kept open, and that people do not stand or sit in it, thus, blocking up the only way air can come in.

Ventilation in cold weather.—In the cold weather, especially in Northern India, it is a good thing to keep a fire burning in a sick-room, if there is a fire-place or chimney for the smoke to escape by ; but if there is not, a fire must on no account be lighted. Neither must a charcoal *angethi* or *ghurra* ever be allowed in a sick-room, either for poultice-making, cooking, or warmth. The fumes from charcoal are most poisonous, and very dangerous in a closed or small room.

CHAPTER II.

POULTICE MAKING—LINSEED—BREAD—JACKET—BRAN AND CHARCOAL POULTICES—THE WAY TO APPLY AND REMOVE POULTICES—DRY-HEAT APPLICATIONS.

Besides keeping a sick-room in good order as regards ventilation, cleanliness, and minor details, a good nurse, as we said, ought to be able to carry out the doctor's orders as regards poultices and other applications, and to be able to make a good poultice, as well as put on fomentations and blisters properly.

In doing any of these things there is, as in everything else, a right way and a wrong way.

Use of a poultice.—A poultice is used for its heat and moisture, to check inflammation, to soothe pain, or to help in drawing out matter: and if it is properly made, it will do what is wanted—if not, it will do more harm than good. Poultices are used principally for producing heat over unbroken surfaces, though used occasionally for wounds: this is much less the case than formerly, antiseptic lotions and sterilized dressings, sometimes covered with waterproof tissue, being used instead.

Getting things ready.—When a poultice is to be made, first get *everything* that is wanted ready—boiling water, a metal or china bowl, a spoon or a broad-bladed knife, and a piece of

clean rag, flannel or brown paper, with the linseed (crushed), or bread or charcoal, of which the poultice is to consist. Then warm everything before beginning. The bowl in which it is to be mixed, the spoon or knife with which it is to be stirred, and the flannel or rag in which it is to be laid, should all be made hot—really hot, not just warm.

Linseed-meal poultices.—Next, if it is a linseed-meal poultice, first scald the basin with a little boiling water, throw that away, and pour in as much water as is wanted according to the size of the poultice. The water must be actually bubbling on the boil, or it will not make either a hot, or a light, poultice. Directly you have poured it in, take the knife in one hand and some linseed-meal in the other, sprinkle in the meal and stir it quickly with the knife all the time and in one direction only. When it is smooth, and stiff, take it out in the lump and spread it very quickly and evenly on the rag, flannel, or paper, leaving about an inch uncovered all round. This is turned in to make the poultice neat, directly it is finished.

If the knife sticks in spreading the poultice, dip it into boiling water, but be very quick.

A thick poultice of course keeps in heat better than a thin one; but if the patient cannot bear a heavy one, spread a thin one; and cover it outside with a layer of cotton wool.

Poultices for the lungs.—In cases of inflammation of the lungs, or any internal inflammation, the linseed may be put into a bag of flannel or calico, or better still, one made

of muslin inside, and flannel or mackintosh outside.

How to prevent sticking.—But if the poultice is for a wound or sore, and the linseed is required to touch the skin, a teaspoonful of glycerine in the water is a good thing to prevent it sticking. A flannel bandage is always the best to keep the poultice in place as it retains the heat.

Directly a poultice gets the least cold, it must be changed, but the new one must be ready to put on before the old is taken off.

Practice necessary.—Practice in poultice-making, as in all else, is certainly necessary, for though it sounds easy enough to make, it is not so easy to turn out a really hot, well-mixed, light poultice. Still as it is a thing everyone should learn, it is quite worth while to buy some linseed and make a few poultices before tormenting some poor sick person with any that are half cold or badly made.

Jacket poultices.—How to make the bags for them.—The most difficult poultice to turn out well is a jacket poultice to cover the chest all round. Generally it is made in one long piece and tied together; but unless anyone cannot only make a good poultice, but is also clever in putting it on, or in changing it quickly, the safest plan is to make it in two pieces. And for this make two large bags, one of flannel for the back, the other of oiled silk and muslin for the front. They must be large enough to meet under the patient's arms, and should have three sets of strings at the ends,—the lower two to tie

together under the arms, and the upper ones to tie together over each of the shoulders.

One side of each bag should be about an inch or two longer than the other, so that it forms a flap to be turned over and tacked down when the poultice is put on. When the bags are ready, that is, each sewn together on three sides, with the strings attached, fill the flannel one with a thick hot poultice, close the flap quickly, put a piece of mackintosh under it, and place it in the bed for the patient to lie on.

Putting on jacket poultices.—Then make another poultice to fill the muslin bag, but this should be thinner as it is to lie on the chest. When both poultices are put on, the two bags are tied securely together, and a thick layer of medicated wool is spread over the upper poultices, covered with a sheet of oiled silk, and lightly tacked to the lower poultice. Medicated wool and oiled silk are the best, it should be remembered, for keeping in the heat of a chest poultice on account of their lightness.

Saving fatigue to patient.—The great advantage of a jacket poultice made in this way is that it saves the patient a great deal of fatigue, because the lower poultice never gets cold so soon as the upper, and, therefore, need only be changed every other time a fresh upper one put on.

Mustard Poultice.—When a mustard poultice is ordered, it is understood it is to be of undiluted mustard flour mixed with linseed meal—the proportion is either equal parts or one of mustard to two of linseed. The mustard should

be mixed separately with lukewarm water, and then stirred in with the linseed.

Bread poultices.—Bread poultices, such as are sometimes ordered for small ailments of the face, eyes or hands, are made in one or two ways.

One way is to crumble up some stale bread, pour boiling water into a well-warmed basin, stir in the crumbs as you would linseed, cover it with a plate, let it stand by the fire for a few minutes and afterwards press it, if it is too moist, before putting it on the rag.

Bread poultices lose their heat sooner than any other, so it is always best to cover them with cotton wool, for a hard cold poultice is worse than useless.

Bran poultices.—Bran poultices are sometimes ordered because of their lightness. They are easily made by half filling a flannel bag with bran, closing it and pouring boiling water over it. The poultice will want wringing out in a cloth afterwards; so that a cloth, and a piece of stick to lift the poultice with, should both be placed ready before the water is poured on.

Charcoal poultices.—For badly smelling wounds charcoal poultices are occasionally ordered. If the place is not very tender, the powdered charcoal is either mixed with linseed and sprinkled into boiling water, or it is simply spread over the surface of an ordinary linseed poultice. But if the wound is very tender, a *chittack* of bread crumbs must be soaked a few minutes in boiling water, and half an ounce ($\frac{1}{4}$ *chittack*) of charcoal mixed with $\frac{3}{4}$ of a *chittack* of linseed afterwards sprinkled in and stirred,

until it is quite soft. A little more charcoal is powdered finely over the surface of the poultice just before putting on.

Putting poultices on.—Poultices for wounds.—Poultices for internal inflammation.—In putting any poultice on, remember always to put one edge gently down first, and lay the rest gradually on. There is no good to be derived from placing a steaming poultice suddenly on to a painful sore, because in nine cases out of ten it is so unbearable that it has to be raised—whereas, if it is held near the place, and gently but slowly put on, it is soothing and not irritating. Generally speaking for wounds, sores, boils or carbuncles a poultice is required with the linseed or bread actually touching the part—but where a poultice is required to relieve deep-seated inflammation, or congestion in any of our internal organs, the lungs, the bowels, &c., it ought not to be applied to the naked skin—but something, such as a thick piece of flannel, which conducts heat badly, must be laid between the skin and the poultice. If this is done, a boiling-hot poultice can be laid on the flannel, and the heat will only reach the skin gradually without causing any pain.

Changing poultices.—Again, in changing a poultice the greatest care is necessary. Directly it ceases to be hot, moist and soft, it must be changed; and the proper way to take a poultice off is to begin at the top and turn it in as you draw it down, so that none of the bread or linseed falls about the bed. When it is removed, the part is gently sponged and covered over

lightly, whilst the fresh poultice is being brought.

After treatment.—Again, when no further poultices are required, a strip of flannel, spongio-piline or cotton wool should be worn over the part for a time to prevent a chill from the sudden change.

Hot bottles, Sand bags, &c.—At times heat alone without moisture is needed, and in these cases either tins, jars or bottles filled with hot water and securely corked or closed to prevent accidents, are wrapped in flannel and applied to the feet, stomach, or wherever ordered —or simply a flat tile or slate is made hot, wrapped up in a flannel and applied,—or again sand or bran is sewn up in a flannel bag or old stocking and thoroughly heated in a *degchie* or oven, and then applied. Great care must be taken not to raise blisters or cause burns on the bodies of the very young or very old, or those suffering from dropsy or paralysis or while unconscious or suffering great pain. Many cases have occurred of serious injury or even death from carelessness in applying unprotected hot bottles to the surface of the skin in even apparently healthy persons. These hot, dry applications are very soothing, especially in rheumatism, as they mould well to the shape of a joint and keep their heat a long time.

CHAPTER III.

FOMENTATIONS—MUSTARD PLASTERS—BLISTERS —LEECHES—EVAPORATING LOTIONS—APPLYING ICE—INHALATIONS.

Besides poultices, other things such as fomentations, blisters, or leeches are sometimes ordered to relieve pain and inflammation, and these again are useful and soothing if properly applied, but the reverse, if carelessly managed. Good nursing consists in taking trouble about every little thing in the sick room, and especially in such things as we are now considering.

Fomentations.—To manage a fomentation properly two large pieces of coarse flannel or *puttoo* are needed, plenty of boiling water, a large tin pail or bath, and a wringer.

A wringer.—A wringer is simply a strong piece of *dussootie* with a wide hem at each end through which two sticks of bamboo are passed.

Flannel for fomentations.—In making a fomentation the wringer is spread out over the bath, the flannel is doubled into a straight piece (the size required), placed on the wringer, and boiling water is poured over it until it is saturated. Next, the bamboos are twisted in opposite directions, until the flannel is wrung as dry as can be, and then it is carried in the wringer to be put on to the patient. It should be covered up with cotton wool like a poultice,

and the wringer, &c., put ready for another fomentation. If the fomentations are required to relieve difficult breathing, they can be placed either on the throat as for croup, or on the chest.

Sponges.—Spongio-piline, which is porous one side and waterproof on the other, is an excellent thing for this purpose, or, if this cannot be had, two large sponges wrung in boiling water are a good substitute, and they have the advantage of being very light.

Turpentine.—Turpentine or opium fomentations are prepared in exactly the same way as plain hot fomentations, with the addition of the oil of turpentine or laudanum sprinkled over the flannel or spongio-piline when it is ready to put on. Particular care, however, is necessary with turpentine fomentations, as it is a very strong remedy, and extremely painful blisters are raised if the fomentation is not properly prepared. The proper way is to sprinkle, not pour, the turpentine on to flannel which has already been scalded, and after that to rinse the flannel.

To relieve irritation.—If the irritation is very great from it, a piece of lint soaked in olive or salad oil, put over the part, will give immediate relief.

Neem-leaves.—A fomentation of *neem*-leaves is often useful in sprains, &c. The best way to prepare one is to boil the leaves and pour the *neem*-water over the flannel.

After taking a fomentation off, it is very necessary to wipe the skin thoroughly dry, and

then to cover up the part with some flannel or cotton wool.

Mustard plasters.—Another method of relieving inflammation quickly is by applying mustard plasters, blisters or leeches. For plasters, mustard must always be mixed with cold water until it forms a paste, and spread thinly, but evenly, on a piece of brown paper or rag.

Applying mustard plasters.—If the patient has a very delicate skin, a piece of tissue paper or very thin muslin may be laid over the plaster next the skin—and if it is to be put on the throat or chest, it should be well covered with flannel or wool, to prevent the fumes from the mustard rising to the mouth or nose, and causing irritation to the lungs. Great care must be taken not to leave the plaster on a moment longer than the doctor orders.

To relieve irritation.—If it has been left on too long, or the irritation to the skin lasts very long, the part should be dusted with a little flour, Fuller's earth, or violet powder. A mustard leaf has the same effect as a mustard plaster and is cleaner, more comfortable, and nicer in every way, as it only requires soaking in water for a few seconds before applying. But there may not be one always at hand, so it is as well to know how to prepare an ordinary plaster.—

Blisters.—Way to apply.—Fluid from blisters.—Blisters which are more slow in their effect, require very carefully putting on *exactly* in the place the doctor orders, because if a blister is *too near* to the inflamed part, it may do harm

instead of good by increasing the congestion. If it is a blistering fluid, it must be carefully painted on with a camel's hair brush, and if it is an ordinary blister, it should be warmed by holding it to the fire or round a can of hot water, and when placed where required, should be kept in position by a bandage, not fastened down with diachylon plaster, as that will cause very unnecessary pain when the blister is rising. A blister should be left on from 10 to 12 hours. A blister must never be applied over a joint, and if fluid is used a circle of olive oil must be painted round the place first. To take a blister off, draw it gently towards the middle from both edges, and if the doctor has ordered the bladder beneath to be pricked, be careful, as the fluid or serum oozes out, that it does not run over the skin. Either have a sponge wrung out in hot water, or a clean piece of soft old linen, to soak it up. Sometimes the blistered part has to be kept open with poultices, or dressed with ointments; but in all cases the doctor's directions are to be carefully attended to.

Leeches.—How to apply.—Where leeches are ordered, one must first be sure they have not already been applied to anyone suffering from an infectious disease—next in applying them, the same care as with blisters is required, to place them exactly where the doctor orders, because a doctor will never order them to be put on near a vein, but always over a bone. The skin where they are applied must always be washed with hot water first, then either the leech is put to the part with a pill box held over it, or a

piece of blotting paper, with a hole or holes pierced in it at the points where the leech is ordered, may be laid on the skin, and the leech kept over this by a wine glass or tumbler. Leeches, if ordered for the inside of the mouth, must always be put into a proper leech glass whilst biting, so that there is no chance of an accident, such as swallowing the leech. Should the leech, however, get either into the nose, mouth, or stomach, it can be removed by very strong salt and water.

How to make leeches bite.—If there is a difficulty in making a leech bite, the skin should be smeared with a little sugar and water, or warm milk, or with a little blood taken from the nurse's finger—but generally, pinching the tail is enough to make them bite or trying very gently to take the creature off again.

To remove leeches.—When enough blood has been drawn, if the leech does not drop off of its own accord, a little salt should be sprinkled on its head, and it will come off at once. Leeches must never be dragged off, as their teeth may remain in the patient's skin and cause great loss of blood. In most cases, pressure with the finger or with a small pad of wet lint will be enough to stop the bleeding, but this is not always successful; and, if these fail, either a piece of absorbent cotton wool, or of lint rolled into a hard cone, and bound tightly over the bite may be tried; or the place may have to be touched with caustic, though this must only be done with the doctor's orders.

Evaporating lotions.—Another way of reducing the temperature of an inflamed place is by evaporating lotions.

The lotion is generally made by adding eight parts of cold water to one part of spirits of wine; a small piece of lint or linen is then dipped in and applied to the part. The lint must be kept constantly wet without taking it off; for, if it dries, it does more harm than good. It is only when the lotion is evaporating, or passing off as vapour, that the inflammation is reduced.

Applying ice.—Ice to the head.—Still another way of reducing temperature is by applying ice. If it is ordered for the head, and an ice bag is not available, the best way is to fill a bladder, or small waterproof bag, half full of ice broken into small pieces with a little common salt added, and to mould it to the shape of the head, and afterwards fasten to the pillow with safety pins. Of course, as soon as the ice is melted, it must be replaced by more.

Ice is always best kept in a blanket, and either hung up or placed on a strainer where the water can run away from it. If it is kept in a glass or basin, the water which soon collects round it, makes it melt much quicker. It is best broken with a long darning needle pressed with a thimble.

Inhalations.—For reducing inflammation in the throat, or in bronchitis, inhalations are often ordered. Inhalation means breathing in, or inhaling steam or vapour. Sometimes hot water inhalations alone are ordered, or hot water with a teaspoonful of vinegar or some tincture

added. Those who can have proper inhalers, have simply to have boiling water poured in, and to breathe the steam through the tube.

Simple method.—Inhalers are receptacles for holding boiling water to which some medicines, such as Friar's balsam or tincture of iodine, is generally added: but a simple inhaler is made by pouring boiling water into a jug with a towel folded into a circular shape placed round the edge. The patient then lays his face on the towel and inhales the steam.

Oxygen is often given to be inhaled in cases of pneumonia and other diseases of the lungs; it, however, requires a special apparatus and a specially trained person to administer it.

Hypodermic injections.—Hypodermic or subcutaneous injections are given by means of a small syringe having a very fine pointed hollow needle. The needle is pushed in under the skin, and the fluid in the syringe in which some drug has been dissolved, is forced gently through it, and the needle withdrawn. The needle and syringe must be sterilized each time before use.

CHAPTER IV.

THE GIVING OF (1) FOOD, (2) MEDICINES—TAKING THE TEMPERATURE—WASHING THE PATIENT—GIVING BATHS—CONVALESCENCE—THE NURSE.

Serving and managing food.—Amongst other things which a nurse is called upon to do in a sick-room is to give food and medicines. As regards food there are several things to remember in serving and managing it, which are quite as important as good cooking and nourishing dishes, as for instance :—

To follow out the doctor's orders exactly with regard to any special diet.

To cook whatever food has been ordered as perfectly as possible—and to take care where soups or beef tea are given, that there is no grease on the surface, or round the sides of the plate.

To serve everything nicely and to bring it in to the patient on a clean tray covered with a fresh white dinner napkin with everything down to the smallest spoon perfectly clean.

Only to put small dainty helpings of anything before a patient at one time—and directly the food is done with, to take it all away.

Neither to cook, warm, or keep any food in the room.

To have separate bowls, cups and spoons for each kind of food, so as to have one bowl for soup, another for milk, another for pudding—also to have a special mark on those in infectious cases—and to wash each thoroughly before using for a fresh supply.

If the patient does not eat all brought in, to take it straight away and not to bring it in again.

Not to give warmed up or stale food to sick people, as it does them no good. They must have everything as nourishing, and as freshly cooked, as possible.

To give all kinds of food either really hot, merely warm or really cold, according as it is ordered.

Covering food.—No matter whether the food is hot or cold, to take it in to the patient with a cover on, and to uncover it in the room. The patient then knows neither flies nor dust have settled on it.

If a dish is too hot, to leave it to cool a little, not to blow on it, as the patient will not fancy it afterwards.

Raising a patient.—If a patient has to be raised up to drink, to pass the hand behind the pillow, so as to support both the head and shoulders. Two fingers put behind the head are no use; and swallowing is difficult where the neck is too much bent.

To have a feeding cup, if possible, when the patient cannot sit up to take food.

Never to wake a patient out of sound sleep to take food, unless the doctor orders it.

Never to give a patient food immediately before washing, or in any other way disturbing him, but to have it ready to give afterwards, especially in cases where a patient is very weak. Never to let a sick child see any other food than what it is to have ; and not to let a child who is well, eat anything in the room that is forbidden the other, as the sick child will probably cry and excite itself. In fever and severe cases, to give food through the night as often as through the day, if ordered.

Wash for the mouth.—If there is an unpleasant taste in the mouth, to let the patient rinse the mouth out before taking food with some wash made by mixing a little Condy's fluid, or permanganate of potash, in some lukewarm water. Enough to colour the water pale pink, is the right quantity.

If the patient is too ill to rinse out his own mouth, it must be cleansed for him. For this small squares of gauze or lint are used, and afterwards burnt. The squares are soaked in a solution of permanganate of potash or boracic acid or lemon juice and glycerine, and then, wrapped round the finger or dressing forceps, they are thoroughly but gently applied to the teeth, gums, roof and sides of the mouth.

Medicines.—Next, as regards medicines, the following things must be remembered :—

To carry out the doctor's orders *exactly*, and to give everything ordered at the exact time. If the time goes by and the medicine is forgotten, not to give a double dose next time,—as instead of doing good it may do great harm,

when very strong drugs are being used. The best plan is to tell the doctor when he comes that one dose was forgotten, and to take care that it does not happen again.

Always to look at the label, to shake the bottle before pouring out, and to re-cork afterwards.

To measure the quantity carefully, either in a medicine glass or spoon. A proper measure is the best, as the size of spoons varies so much.

To measure in a minim glass when drop doses are ordered.

If any liniment marked " Poison " is ordered, to keep it in a separate place from medicines to be taken internally.

To give all medicine in perfectly clean glasses or vessels.

To have separate glasses, and separate measuring glasses, for castor oil, cod liver oil, or any medicines with a strong taste.

For taking the taste of nasty medicines out of the mouth, to give a piece of hard *chapatti*, dry bread or ship's biscuit to be chewed and spat out. This is far more effectual than rinsing out the mouth with water—though it is only practicable with grown up people, as children might swallow the dry biscuit and upset their digestion.

Not to awaken a patient from sleep to have medicine any more than food, unless the doctor orders it.

And lastly, to recollect that medicines alone cannot cure people,—that careful nursing, plenty of fresh air and cleanliness in everything

are wanted as well, if the patient is to recover quickly.

Rectal Medication.—Occasionally medicines have to be introduced into the bowel when a patient is unable to swallow or is vomiting; if liquid, they are injected or allowed to run through a rubber tube which has been pushed into the bowel for the purpose; if solid, they are mixed up in a waxy conical mass, and so inserted into the bowel.

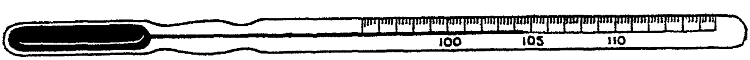
When it is required to clear out the lower bowel, an injection or enema, consisting of a pint of warm water—temperature 100F.—in which has been dissolved an ounce of soft or good yellow soap, is passed into the rectum and allowed to remain until an action results. Sometimes four ounces of olive oil, or one of castor oil and three of olive oil, are injected 15 or 30 minutes previously.

To relieve pain or irritation in the lower bowel, or to check diarrhœa, 2 ounces of warm thin starch fluid is mixed with a prescribed amount of tincture of opium, and after being passed into the bowel is retained there.

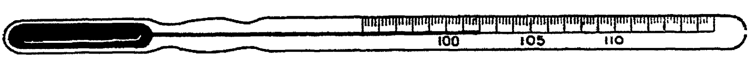
Nutrient Enema.—When food cannot be retained in the stomach, or when in certain diseases it is not advisable to give food by the mouth, 3 or 4 ounces of predigested—peptonized—food may be given every four hours. Its chief constituent is usually milk; and before it is given, the bowel should be washed out with a little warm water each time, and once or twice in the 24 hours, with a full enema of the same kind.

Sometimes where there has been a great drain on the body as in much bleeding or in cholera, warm rectal injections of water to which has been added sodium chloride—salt—$1\frac{1}{2}$ drams to the pint—are given to the extent of half a pint, or one pint, every two or four hours.

Temperature-taking.—Another duty of the nurse is to "take" the patient's temperature for the doctor in fever cases. There is a special thermometer called a *clinical* thermometer, small enough to be put in anyone's mouth, which must be used to take temperatures. To do this the thermometer must be below 97° Fahr. because the natural heat of the body is 98·4° in health—and taking the patient's temperature helps the doctor to see how much hotter he is at different times of the day or night than he should be—and, therefore, how high the fever is. To get the thermometer below 97° if it is higher, it must be shaken down by swinging the arm, not by knocking one hand against the other.



This registers 104·5°.



This registers 102°.

This registers Normal temperature 98 4°.

Care in recording temperature.—In grown-up people the temperature is taken by putting the thermometer either under the tongue or in the armpit, or in the groin, or in the rectum. It must be kept under the armpit about five minutes to see what the temperature really is, but three minutes is enough under the tongue. When taken in the rectum, the bulb should be smeared with vaseline, inserted for about one inch and held there. In children it is better to take it either in the armpit or groin, always allowing three or five minutes. When the mercury stays at one line and goes no higher, the temperature is "taken," and it must be written down at once to show to the doctor: remember every little line on the thermometer may mean a great deal. If the mercury goes beyond, say, 100, every little line it creeps up to means danger, and therefore, not only must 100 be written down, but if it goes to the next little line above, 100·2 must be put down, as that means it is two-tenths above the hundred; and if it goes to the next line, it will be four-tenths or nearly half way on to 101.

Each time the temperature is taken, these little half lines must be noticed very carefully, as the doctor cannot tell what effect his medicines is having, unless he knows exactly how the temperature varies. And here it is important to note that a nurse must not trust to memory, but must keep a memorandum book on the table. Have a page for each day of the month, and each day note down everything of importance. This will include the temperature

morning and evening, the times and quantities of food, the hours of medicines, etc. When the temperature remains constantly at a high level, it is said to be "continuous;" when there is a very considerable difference between that of the morning and evening, the fever it indicates is known as "remittent;" while an "intermittent" one is that in which the temperature is at or below the normal sometime during the day and night. A fever may end in "crisis" when it drops abruptly to normal in from 12 to 24 hours, or in "lysis," when the descent is much more gradual. Nurses must be prepared for shivering fits or rigors, as they often mark the onset of an acute fever or serious illness—the temperature of the patient must be taken, hot bottles and blankets used to produce a feeling of warmth, and hot drinks given, while careful report of the occurrence is drawn up for the doctor.

Washing the patient.—Another very important duty of the nurse is to keep the patient clean—people, when ill, want washing as much as when they are well, if not even more. In India unfortunately many people leave off washing themselves or their friends directly they are ill, but all those who understand the action of the skin, will know how foolish and harmful the custom is. People must be washed every day whilst they are ill, unless they are very, very weak; and even then, perhaps they can bear sponging nearly all over.

Washing refreshes them, and helps them to get well, because it keeps the skin acting. Sick

people should be washed with warm water, clean soft flannel or a fine linen rag, and a little good soap, and the skin thoroughly dried afterwards. Sponges are never a good thing for a sick-room, as they absorb dirt so quickly and cannot be cleaned easily. Where a patient has to be washed in bed, it must be done between blankets with a waterproof sheet under the bottom blanket; and the whole of the body must be thoroughly gone over. Whilst washing a patient, a nurse should note whether there are any signs of bedsores. Bedsores are generally a mark of carelessness in the nurse, and the consequences are most serious to the poor patient. First of all, the skin where the greatest pressure is on the back becomes red, then dark looking, and then it gives way and a wound appears. It may be painless, and not even suspected by an untrained nurse, until it is in existence. The only way to prevent this calamity is to attend most carefully to the cleanliness and sweetness of the patient's skin, and to be sure and not bruise or injure it when attending to him. The draw—and under—sheets must be kept quite dry and smooth, as also the patient's clothing, night-gown, etc. Unless there are orders to the contrary,—the patient should not be allowed to remain long in one position—and if the illness is likely to be a long one, the skin over the bones of the back and hips should be gently rubbed with equal parts of spirit and water, and then dusted with oxide of zinc and starch powder after each time it is washed and dried.

Baths.—In cases where baths are specially ordered, the doctor will say whether a hot, warm, tepid, or cold bath is to be given, with the temperature he wishes it—and then the nurse must try the water with a thermometer before letting the patient get in—

A Hot Bath is from	98° to 105°	Fahr.
A Warm Bath is from	92° to 98°	,,
A Tepid Bath is from	85° to 92°	,,
A Cold Bath is from	56° to 65°	,,

A patient should stay in—

A Hot Bath not more than	10 to 15	minutes.
A Warm Bath from	14 to 20	,,
A Tepid Bath from	14 to 20	,,
A Cold Bath from	5 to 6	,,

Before the bath is commenced, plenty of warm clean towels should always be put ready to rub the patient dry with, and all the necessary clean linen should be well aired and ready to put on in the order they are wanted.

Convalescence, care in.—When patients are getting well, that is, are convalescent, a good nurse will still be careful about many small matters, as for instance, that the patient does not catch cold, that many visitors do not crowd in, or talk too much, and that the patient has enough variety without fatigue.

Clothing.—Dangers after special diseases.—A convalescent should always be clothed in thin or thick flannel or woollen stuffs according to the time of year. This prevents chills which are very dangerous to people recovering from any chest diseases, or from rheumatic fever, measles, diphtheria or scarlet fever—in fact, after scarlet

fever, measles or small-pox, even a slight chill may cause other diseases which, if they do not actually kill the patient, may leave him an invalid, or delicate in many ways, for life. Whilst as regards rheumatic fever, patients perspire so profusely both during and after the illness, that they should always not only wear flannel, but also sleep only in blankets. This would prevent heart disease in many cases, because flannel and blankets absorb perspiration. Still they must always be changed or washed frequently, or they will soon smell.

When anyone is convalescent from any disease in which the stomach and bowels have been affected, great care must be taken with regard to the dieting, so that only such foods as the doctor orders are given.

Hunger, in convalescence.—Hunger is the first and a very good sign of convalescence; but it is no use giving too much food at first, because the organs of digestion are all very weak and cannot digest much. All convalescents, as they have a great deal of strength to make up should eat little and often, masticate their food well, and eat those foods which agree best with their stomachs.

Dangers after Typhoid or Enteric fever.—This is especially necessary to remember after typhoid fever, when meat given too early may kill the patient. In typhoid fever, ulcers are formed on one part of the small intestines called Peyer's Patches; and if meat or too hard food is given before these ulcers are healed, the wall of the intestine may break at the place where the ulcer

has eaten into it, and so the food find its way into the Peritoneal cavity and cause inflammation and death.

These ulcers may even break by a patient merely raising himself up in bed, so that perfect rest and soft digestible foods are very necessary for anyone recovering from typhoid fever. Amongst soft digestible foods however, no fruits, especially those which have pips or stones, like grapes or plums, must be included after typhoid fever. Convalescence after enteric fever is always very gradual; sitting up suddenly may cause heart failure, and clots in veins form, especially in the legs, which give great pain. A nurse must be careful not to massage these, as the movements may cause the clot to separate.

No solid food must be given, unless with the doctor's express order, until the temperature has been normal for 10 days or a fortnight.

Getting up after illness.—The getting up after *any* severe illness should be very gradual, as a patient may have a bad fall by trusting to his own strength and getting out of bed alone too soon.

Cleanliness in Nursing.—In all nursing great cleanliness is essential; but in the nursing of surgical cases it means not only ordinary cleanliness, but freedom from germs—to prevent germs from entering a wound we have to be sure that everything used during an operation, or when attending to a wound, is sterile, *i.e.*, free from living germs. All instruments and apparatus are sterilized by boiling for ten minutes—as also towels and swabs for sponging—unless they

can be placed in a sterilizer provided for the purpose. Knives are not generally boiled, as this blunts them, but are dipped into pure carbolic acid and wiped with a sterilized swab. The hands of all who have to do with nursing, and especially surgical cases, must have minute attention—the nails must be kept short, thoroughly trimmed, and cleaned not only in soap and water, but soaked in a disinfectant, such as tincture of iodine. If after thus attending to the hands anything is touched that has not been sterilized, the whole cleaning and disinfecting must be done over again; as for instance, if perspiration is inadvertingly wiped from the face, or the patient's clothes are touched where not protected by sterilized towels, etc., you must be just as careful in dealing with small accidental injuries as cut fingers, as neglect of these precautions will not only retard recovery, but may lead to disastrous results.

A good nurse.—And now a few words in conclusion as regards the nurse. A good nurse will always be careful to keep constant control over her face and tongue—never to let the patient see by her face that he is dangerously ill—not to speak loudly, but at the same time not to whisper in a sick room—to speak in a cheerful tone—to move about quietly, and not to upset things constantly—to be patient and not to hurry either in washing a sick person, or in taking away eatables when done with—to be sympathetic, but firm as regards carrying out the doctor's orders—to notice what effect medicines have, or whether there are any new symptoms to

tell the doctor—to look after her own health and to take at least seven hours for sleep as well as not less than half an hour's brisk exercise twice a day—to wash herself thoroughly all over every day with soap and water—to put on clean clothes throughout frequently and, if possible, only to wear dresses that will wash.

Lastly, in all things to remember " to do as she would be done by.

CHAPTER V.

INFECTIOUS DISEASES—PRECAUTIONS DURING ILLNESS—DISINFECTION AFTER ILLNESS OF ROOM—BEDDING—CLOTHING—THE BEST DISINFECTANTS—TABLE OF TIMES OF INCUBATION AND INFECTION—DIETS AND NURSING IN CONSUMPTION.

Character of infectious diseases.—Origin of these diseases.—Infectious diseases which are quite unlike all ordinary complaints, because they spread from one person to another, require not only careful nursing as regards the patient, but special precautions to prevent them spreading. If every single person who was ill, was properly taken care of and not allowed to go near other people until the doctor said they might, we should do a great deal to stamp out these diseases; but then *everyone* must help.

Mode of spreading.—Infectious diseases spread in different ways, as we saw earlier in our Hygiene lessons; and stringent precautions are necessary on the part of all connected with a patient from the moment it is known what is the matter.

Precautions to prevent spreading.—These precautions which everyone should take directly an infectious complaint breaks out in a house, are:—

If the house is small or the people are not well off, enquire if a bed can be had in a Public Hospital.

If the patient is to be nursed at home, make the top room in the house the sick-room, and remove all *durries*, curtains, and everything that is not wanted in the way of furniture or clothes.

Do not allow anyone but the doctor and nurse to go near the sick person. If more help is necessary, choose servants, who, if possible, have already had the disease.

Do not allow such servants to mix with the others, or to go to the bazaar, or in any way to mix with others until the illness is over and their clothes have been disinfected.

The nurse or anyone else attending the patient, to wear cotton or washing dresses, to put clean ones on very often, and to be protected by Vaccination in small-pox, and by the special inoculation in Plague, in Diphtheria and in Enteric.

If there are children or many people in the same house, try to get some relatives or friends to have them till the illness is over.

If children have to live in the same house, keep them away from school and apart from all other children.

Allow no visitors at all in the sick-room.

Keep the room well ventilated, let plenty of fresh air in, as that is the best and cheapest disinfectant. If there is a chimney in the room, keep a fire always burning, as that draws a lot of the foul air away. And remember that ventilation is doubly necessary in a sick-room because the patient is always in it, night and day. A good plan is to keep two upper windows

opposite each other always open; and at least once or twice a day, if it is cold weather, to cover the patient well up, and throw all doors and windows open so as thoroughly to change the air.

Cut the sick-room off from the other rooms by hanging up a thick cotton sheet wetted with some good disinfectant (such as carbolic) 1 in 60 or 1 in 80. A disinfectant is something that kills germs.

In diphtheria or whooping cough, let the patient spit into sawdust, and burn it.

Always put disinfectants, perchloride of mercury (1 in 500 or phenyle, into the commode or chamber, before it is used, as well as directly after it is used. Have it covered up and taken away to be emptied at once, and the commode or chamber again washed out with disinfectant.

All excreta from infectious patients should be at once mixed with perchloride of mercury (1 in 500), and either burnt in an incinerator or buried, and they should be kept in contact with the perchloride at least an hour before being disposed of.

Give the patient small squares of soft muslin or old linen, or better still, soft paper to use instead of handkerchiefs, and burn them directly they are used.

Give the patient old linen to wear, if possible, and burn it all when it is dirty.

Never send sheets or clothes to the *dhobie*, unless they have been soaked in disinfectant, carbolic or perchloride of mercury.

Keep some cups and saucers, plates, dishes, knives, forks, spoons, glasses, &c., specially for the sick-room; have them specially marked, *e. g.*, E for enteric; and always wash them in disinfectant, such as Condy's, each time after they are used.

Lastly, do not allow the patient to travel by rail or *dâk gari*, until the doctor says the danger of infection is past. After the illness is over the sick-room and everything in it must be thoroughly disinfected.

Disinfection after illness.—The room and clothes.—To do this, hang up all clothes and the bedding in the room well spread out. Put some sulphur—1 lb. or ½ a *seer* for every thousand cubic feet of space is the right quantity—into an iron pan or *gumla* resting over a bucket of water in the middle of the room; or if, it is a large room, in pans in two or three places in the room; next, shut all doors and windows, and if there are gaps, paste paper over them so that no air can get in or out. When all is ready, put a few pieces of burning charcoal in between the sulphur on each pan, and directly it is lighted, shut the door you go out by, and paste that over outside down the opening with paper—leave the sulphur to burn, and keep the room shut up for 24 hours. The next day open all the doors and windows and have them open as long as possible. Let the upper windows be open all night, and put all the clothing or bedding out in the sun all day.

Washing clothes.—Whatever clothes can be washed must then be sent to the *dhobie*; and

when they are turned out, the floor, all the doors and all the furniture must be scrubbed with soap and water, followed by phenyle or some other disinfectant.

Scraping walls.—If the floor and walls are mud, they must be scraped, and then washed with fresh clay water.

Burning things after Cholera and Small-pox.—After cholera or small-pox it is safer to burn everything, even the bed and bedding, as, if they are not thoroughly disinfected, people may catch either disease from them years afterwards; but with the other diseases it is generally quite enough to disinfect clothes, bedding, and everything else from the room, if it is thoroughly and carefully done.

Disinfectants.—Now what are the best disinfectants?

Sulphur.—Sulphur is, as we have said, the best for burning in a room after illness.

Condy's fluid.—Condy's fluid, which should be made sufficiently strong to form a pink colour by mixing about a teaspoonful of permanganate of potash with eight *seers* of water, does not smell, and is excellent to sprinkle on the floor, or stand in basins in the room. It is also the best thing to put into water for washing the patient, or into that in which the nurse washes her hands. It can be used quite safely either for the skin of the face or the hair.

Carbolic acid.—Carbolic acid has a very strong smell, and is very irritating to some people, so it is best only to use it for clothing or things out of the room. Either this (strength 1 in 20) or

perchloride of mercury (1 in 1,000) is excellent to put in the water in which clothes or sheets are being soaked before sending to the *dhobie.*

Perchloride of Mercury.—1 in 500 is used for disinfecting excreta, and 1 in 1,000 is used for soaking clothes in.

Tincture of Iodine.—Is used for disinfecting the hands and for painting the skin some few hours before operations, and again just before commencing to operate.

Table of illness.—Incubation and eruption.— The following table will be found useful for knowing how long each illness takes in coming out after the patient has "caught" it, and also how long the infection of each lasts :—

Disease.	Incubation period	Date of the definite illness on which the eruption.		Period of quarantine required after the *latest* exposure to infection.	Period of infection ceases
		Appears.	Begins to fade		
ASIATIC CHOLERA.	A few hours to 10 days, usually 3 to 6 days.			12 days .	In 7 days from complete cessation of diarrhœa
CHICKEN-POX.	10 to 16 days	1st day and 3 following days.	About 4th.	20 days ..	When every scab has fallen off
DIPHTHERIA	2 to 10 days	.	.	12 days ..	In 4 weeks. if no discharges and no albumin, and if bacteriological examination of nose and throat be negative
GERMAN MEASLES (Roetheen).	7 to 18 days or even longer.	2nd to 4th...	4th to 7th	20 days .	In not less than 10 days from appearance of the rash.

Disease.	Incubation period.	Date of the definite illness on which the eruption Appears.	Begins to fade	Period of quarantine required after the *latest* exposure to infection.	Period of infection ceases.
MEASLES ...	10 to 14 days	4th day. The patient is highly infectious for 2 days before the rash appears	5th to 7th.	16 days ...	In not less than 2 weeks from appearance of the rash.
MUMPS .	10 to 22 days.	..	..	24 days .	In not less than 3 weeks, and then only when 1 week has elapsed since subsidence of all swelling
PLAGUE ..	2 to 8 days, in rare cases up to 15 days	.		3 weeks .	In one month.
RINGWORM	.	.	.		When examination reveals no broken-off diseased hairs
SCARLET FEVER.	1 to 8 days, usually 3 to 5.	2nd ..	5th	10 days ...	When desquamation and sore throat and albuminuria disappear, but never in less than 6 weeks.
SMALL-POX	12 to 14 days.	3rd or 4th	9th or 10th.	16 days ...	When every scab has disappeared.
TYPHOID FEVER.	7 to 21 days, usually 10 to 14.	8th or 9th...	21st	23 days ...	Indefinite (typhoid carriers).
TYPHUS ..	5 to 14, very variable.	5th .	14th	14 days ...	After 4 weeks.
WHOOPING COUGH.	7 to 14 days	The characteristic whooping may not appear for 3 weeks, although the patient is infectious before then.	.	21 days	In 5 weeks from commencement, provided all characteristic spasmodic cough and whooping have ceased for at least two weeks.
YELLOW FEVER.	3 to 6 days, and in rare cases 13.	...	.	15 days	...

Consumption.—Tuberculous disease, known also as Consumption or Phthisis, when it attacks the Lungs, may attack any part of the body.

We have seen in our Hygiene how it is spread; and in nursing a case of consumption of the lungs it is most important always :—

(*a*) To insure the patient living and sleeping in as fresh, pure, outdoor air as possible.

(*b*) To have all clothing light and loose, woollen if possible, for night and day wear, and the feet kept warm and dry

(*c*) To have regular exercise, regular hours and to avoid fatigue.

(*d*) Every night to sponge the whole body with warm water or, if the patient can bear it, with cold water (rapidly), followed by friction with a rough towel and a flesh glove. The regular long attention to the action of the skin forms one of the most important factors in the hygienic treatment of this disease; when there are night sweats, it may be necessary to wash with soap and water before rubbing the skin.

(*e*) To disinfect at once everything coming away from the patient's nose and mouth.

The proper way is for a consumptive patient to have a special bowl or basin filled with sawdust, or perchloride of mercury or Phenyle (1 in 500) to spit into, and paper handkerchiefs to use. The spittle should afterwards be emptied on to burning charcoal, and the handkerchiefs burnt. If a consumptive person spits

on the floor of the room, or on the ground anywhere near the house, he may not only give the disease to other people, but fowls or other animals may get it, and, if we eat those animals as food, we may get it through them.

Good nourishing food is also of the highest importance. It should be appetisingly cooked and daintly served, a great deal of milk, cream, raw eggs and butter being given—and these should be served in as varied a manner as possible. The chief things to avoid are—veal, pork, hard or salt meat and re-cooked food, pickles and *masalah*. The following dietary is one that may be followed :—

(*a*) On waking, milk, hot or warm, gradually increasing in quantity till ten to twelve ounces are taken. It may contain a little sodium phosphate to help the bowels, or sodium bicarbonate or sodium citrate to render it more easy of digestion.

(*b*) If preferred, there may be given, as a morning stimulant, a breakfast cupful of tea made with milk instead of water.

(*c*) Breakfast, one hour later, should be substantial, and is better taken in bed before washing and dressing.

(*d*) One hour and a half after breakfast (so as not to spoil the appetite for luncheon), one raw egg, or two if possible, broken into a glass and swallowed whole, with pepper and salt, or beaten up with a little milk ; or raw meat, alone or in sandwich ; or Perfected Wyeth Beef Juice.

(*e*) Mid-day, a substantial meal, with (when indicated) beer, red wine or spirit.

(*f*) One hour and a half after luncheon, milk, raw eggs, or raw meat.

(*g*) In the afternoon, tea made with milk, or milk, with raw eggs or raw meat, and abundant bread and butter.

(*h*) At 7 or 7-30, a substantial meal.

(*i*) At bedtime, milk, and if possible a raw egg in it, or with it.

With this disease, as with so many others, cleanliness is the best remedy, not only to help cure those who are ill, but to prevent those who are well from getting the disease.

Plenty of fresh air and dry houses to live in will do a great deal to stamp out consumption even in those who are born of consumptive parents.

CHAPTER VI.

SICK-ROOM RECIPES—DRINKS—NUTRITIOUS DISHES.

The following recipes may be found useful in the sick-room :—

Rice Water.—Wash one *chittack* of rice in cold water, boil for an hour, strain and sweeten. For an acidulated drink add the juice of one lemon. For a plain drink add cinnamon.

Barley Water (thin).—One *chittack* of well-washed barley, a little lemon peel and sugar. Pour half a *seer* of boiling water on. Cool and strain.

Barley Water (thick).—To make it thick put the same quantities into an enamelled saucepan, and boil for two hours. Strain into a jug containing lemon-peel and sugar. Add lemon juice to either drink, especially in fever cases.

Oatmeal Water.—Boil two *chittacks* of oatmeal in two or three *seers* of water, and add $\frac{1}{2}$ *chittack* of sugar. If it is too thick, add more water according to taste. Pour off the fluid and add lemon juice.

Lemonade.—Put the peel of a lemon, cut very thin into a jug with $\frac{1}{2}$ a *chittack* of sugar. Squeeze the juice on to it and add half a pint of cold water, or if preferred, a bottle of soda water.

Orangeade.—The juice of three or four oranges and one lemon with a little sugar added to a *seer* of cold water.

Toast Water.—A crust of bread toasted brown (not burnt): add two or three cloves. Pour cold water on it, let it stand for half an hour. This mixes well with the next drink.

Apple Water.—Put three roasted apples into a jug with lemon peel and sugar; add ½ a *seer* of boiling water.

Linseed Tea.—Pour a seer of boiling water on to 3 tablespoonfuls of linseed in a tea-pot or jug, cover it and let it stand for 4 hours to draw, strain it and sweeten with honey or sugar, or flavour with liquorice or lemon juice.

Bran Tea is made in the same way.

Sage Tea.—Pour one *seer* of boiling water on ¼ of a *chittack* of green sage leaves (if *dried*, less is needed)—a little sugar and the rind of a lemon. Let it stand near the fire for half an hour, then strain.

Baël Drink.—One or two tablespoonfuls of the liquid extract of Baël fruit—or rather more of the fresh pulp, to half a *seer* of water, and sweeten to taste.

Cooling drink in fevers.—One teaspoonful of cream of tartar, a lemon sliced, two tablespoon of sugar, and a ½ *seer* of boiling water or barley water. Leave till cold—then use.

Milk and Soda Water.—One teacupful of milk heated till it nearly boils. Put a teaspoonful of sugar with the milk into a large tumbler and add half or more of a bottle of soda water.

Beef Tea—Take ½ *seer* of fine juicy steak—cut it up finely, removing all gristle and fat—put it in a stone or earthenware jar (not any metal *degchie*) with ½ a *seer* of water—place the

lid on the jar and tie paper over it. Let it soak for an hour, then place it near the fire for three hours, and half an hour in an oven or in a *degchie* of boiling water. When cold, skim, and heat up as required. Good beef tea should never be boiled, neither should it set into a jelly; therefore no bones or gristle should be put in, as the *juice* of the meat and not gelatin is wanted.

Beef Tea, when wanted quickly.—Half a *seer* of beef finely chopped—with all fat, &c., removed—half a *seer* of cold water. Bring it quickly to the boil, and boil for five minutes.

White Wine Whey.—Put two pints of new milk in a saucepan and stir it over a clear fire till it is nearly boiling; then add four ounces of sherry, and simmer for a quarter of an hour, skimming off the curd as it rises. Then add a tablespoonful more sherry, and skim again for a few minutes.

Rennet Whey.—To a quart of new milk, either warm from the cow, or heated up to the same temperature, add a large tablespoonful of rennet. Keep up the heat a little higher till the curd rises, and take it off with a spoon.

A speedy and palatable whey can be prepared by adding the fresh juice of limes or lemons to milk instead of sherry, and treating it similarly.

Mutton Broth.—Half a *seer* of lean meat, without bone, to half a *seer* of water. Boil gently till very tender, putting a little salt and onion to flavour. Pour the broth into a clean basin, and when cold skim off the fat. Warm as wanted. If barley or rice are added, they may

either be boiled separately till soft, and added when the broth is warmed for use, or cooked with it.

Chicken Soup.—Mince a small tender chicken. bones and all, put it in a jar just covered with cold water, and let it stand for two hours. Then close the lid on with *atta*, and bake or boil for an hour. This should give very strong good soup. Mutton or beef soup can be made in the same way.

Egg Soup.—The yolks of two eggs beaten up together over a slow fire, with half a seer of water added gradually, a small lump of butter and a little sugar. When it begins to boil, pour it from the *degchie* to a jug and from the jug to the *degchie*, till it becomes quite smooth and frothy.

Almond Soup.—(Very nourishing). Put two *chittacks* of washed rice into a *degchie* with $\frac{3}{4}$ of a *seer* of milk, a little salt and sugar, and simmer over a slow fire for an hour. Then add two *chittacks* of sweet almonds and four or five bitter almonds, peeled, blanched and pounded in a mortar with a $\frac{1}{4}$ of a *seer* of milk added during the pounding. Add half a *seer* more milk when they are pounded smooth, and strain. Heat this mixture, stirring it all the time, but do not let it come to the boil, and when hot, pour it over the rice to serve.

Rice Gruel.—(In diarrhœa).—Boil one *chittack* of ground rice in two *seers* of water with a little cinnamon for forty minutes. Some people like this with a tablespoonful of orange marmalade added.

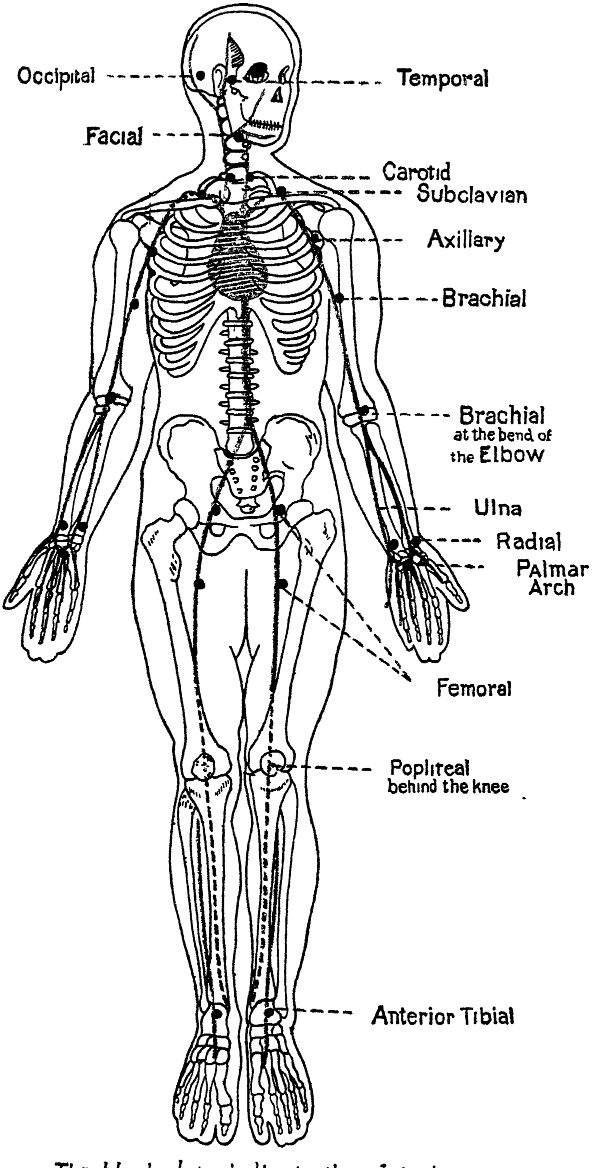
Gruel.—Gruel may be made with milk and water mixed, or either alone. Put two tablespoonfuls of oatmeal in a *degchie* well-mix with a little water, then add half a *seer* of milk or water, and let it boil gently for an hour, stirring it often. Flavour with sugar or salt. When nourishing gruel is required, milk and hot water should be used.

N. B.—It must be remembered that patients cannot live on beef-tea, soups or drinks alone. The soup recipes here given are for the most part stimulating. To obtain nourishment as well as stimulant, starchy foods, such as rice, sago, tapioca, or barley should be simmered with the beef tea or soup for four or five hours, and then strained. Beef-tea alone is practically only a stimulant.

SECTION IV.

ACCIDENTS AND EMERGENCIES.

THE ARTERIES OF THE BODY



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SECTION IV.

ACCIDENTS AND EMERGENCIES.

CHAPTER I.

FIRST AID—BLEEDING OF DIFFERENT KINDS—WAY TO STOP BLEEDING IN THE DIFFERENT PARTS OF THE BODY—TRIANGULAR BANDAGES—WAY TO FIX BANDAGES IN DIFFERENT PARTS—ROLLER BANDAGES.

First aid.—In daily life we are sometimes called upon to help people who have met with accidents or are taken suddenly ill. Everyone ought, therefore, to know what to do in such cases before the doctor arrives, as lives may often be saved by injured people being attended to directly they are hurt. They may have only a small cut or a slight sprain, but they may also have a bad wound which if not attended to on the spot may cause them to bleed to death; or a broken bone which perhaps if not protected from further injury at once may leave any one a cripple for life.

Now whether it is a small cut or large wound, the first thing to do is to stop the bleeding.

To stop bleeding.—To stop bleeding in all cases except where it is very slight, four things must first be done :—

1. Place the person lying down and raise the part which is bleeding on a cushion or something rolled up to support it.

2. Press the wound if small, with the thumb or fingers until you have found something to bind it with; if large, on the pressure point on the heart side of the wound. By a pressure point is meant a spot where we press on the skin over an artery to stop the flow of blood in it from the heart. It is better to learn the pressure points to stop bleeding off by heart—they are given on the figure of the skeleton—each point represents the best place to find the artery where it can be pressed against a bone to stop bleeding in a wound that is taking place in a wound the opposite side from the heart, *e. g.*, for a wound below the elbow you press on the inside of the middle of the upper arm in about the line of the sleeve seam.

3. Wash the wound with clean water to remove any dirt.

4. See whether the bleeding is from an artery, vein or only the surface.

There are three kinds of bleeding, and it is not difficult to find out which kind it is if we remember that—

(1) *From arteries* the blood spurts out and is bright red.

(2) *From veins* the blood flows slowly and evenly and is of a purplish colour.

(3) *From very small vessels and capillaries* the blood oozes out, that is, it flows slowly.

To stop bleeding from arteries tie a hard pad tightly above the wound on the side nearest the heart so as to press the main artery against the bone, and then tie another over the wound.

The pad should be a hard dry pad of Boracic gauze or lint, or if not at hand, a clean piece of linen or unprinted paper may be used, but perfect cleanliness must be remembered to prevent germs entering the wound.

Fig. 5.

To make a pad and bandage in one, take a three-cornered piece of cotton cloth, tie a knot in the centre (Fig. 5) with something hard such as a stone, a rupee or pice, or anything handy, pushed into the knot, and place the knot exactly on the wound before tying the ends of the bandage. To tighten the bandage, make a "tourniquet," Fig. 5*a*, by pushing a pencil or piece of wood under the bandage knot and turning it round as tightly as possible before fixing it.

Fig. 5*a*.

Bleeding from veins is stopped in the same way, but the first pad must be tied *below* the wound or furthest from the heart. It is easy to remember these two ways of stopping bleeding

when we think that as the blood in arteries is flowing *from* the heart it must be stopped coming from the side nearest the heart, and that as the blood in veins is going *to* the heart it must be stopped coming from the side furthest from the heart.

Bleeding from very small vessels is stopped by cold water bandages, or an ice bandage, or by bathing with very hot water. The two extremes, very hot and very cold water, have the same effect in stopping bleeding.

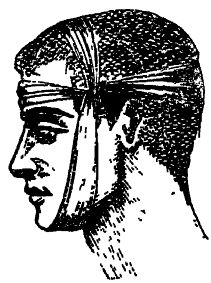


Fig. 6.

The different parts of the body cannot of course all be bandaged alike and some are much easier to bind up than others—

To stop bleeding from—

1. *The Head.*—Fig. 6.—Put a thick pad over the wound and place two bandages over it, one round the head, the other under the chin and over the head.

Fig. 7.

2. *The Neck.*—Fig. 7.—One cannot bandage at all, but only press with the fingers over the wound, and the large vessels above and below it, pressing backwards against the spine.

3. *The Armpit.*—Press a firm large pad under the arm on the wound and bind the arm down

to the side. If the bleeding does not stop, press with the thumb on the artery which can be felt at the root of the neck behind the inner bend of the collar bone.

4. *The Arm above the Elbow.*—Fig. 8.—Tie a pad on the wound and another above, on the inner side of the arm—that is on the line where the coat seam passes down.

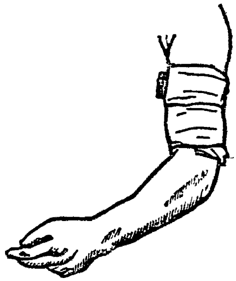


Fig. 8.

5. *The Arm below the Elbow.*—Fig. 9.—Put a pad in the hollow of the bend of the elbow, bend the lower against the upper part of the arm and bandage together.

Fig. 9.

6. *The Hand.*—Fig. 10.—Put a firm pad or piece of smooth wood on the wound, close the fingers on it, tie a bandage round the fist, and put the arm and hand in a broad sling. If the bleeding is very much, tie two pads firmly over the arteries or pulse at each side of the wrist.

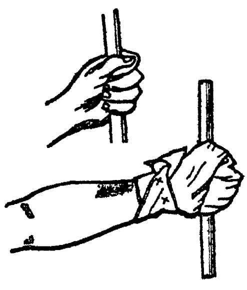


Fig. 10.

7. *The Thigh.*—Put one pad on the wound, and a second above on the inner side of the thigh, bandage both lightly using a tourniquet, and if necessary press the artery

with the finger knuckles in the middle of the fold of the groin.

8. *Back of the Knee joint.*—Pad and bandage over the wound and again above, using a tourniquet.

9. *The Leg.*—Pad and bandage over the wound and above, and press on the artery at the back of the knee joint. If that is not sufficient to stop the bleeding put a pad in the hollow under the knee, double the leg back against the thigh and bandage tightly as in the arm.

10. *The Foot.*—Pad and bandage the wound and bind pads behind the inner and outer ankle bones. Put another pad and bandage on the middle of the front of the ankle if necessary, and if this fails put a pad under the knee, bend the leg back and tie it to the thigh.

11. *The Chest* or any part of the *Abdomen.*—Place the patient lying down on the wounded side, with the knees drawn up, apply cold water or ice to the chest, and give ice to swallow frequently, but no wine or stimulants.

12. *The Nose.*—Raise the arms, apply cold water or ice to the nose and forehead. If this fails put some cotton wool soaked in alum and water (five grains to an ounce of water) up the nostrils, or let a little alum powder be sniffed up.

Triangular bandages.—The best kind of bandage for any part of the body is the "triangular" bandage. A piece of calico, forty inches square, if cut cross-wise from one point to the other, will make two of these three cornered or triangular bandages.

The longest side of the bandage is called the "lower border" and the point opposite it is called the "point."

When a broad bandage is needed the point is brought down to the lower border and the bandage then folded *in two*.

When a narrow one is wanted the point is brought down to the lower border and the bandage then folded *in three*.

Bandages should always be fastened either by sewing, by a safety pin, or by a reef knot, Fig. 11, which cannot slip.

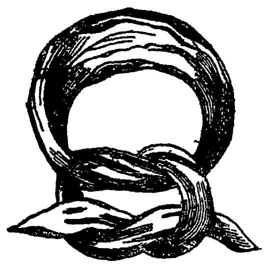


Fig. 11.

Triangular bandages, although all made alike, are folded and placed in several ways according to the shape of the part they are intended for.

For the Head.—Figs. 12, 13.—Fold a hem about $1\frac{1}{2}$ inches wide along the lower border, put the bandage on with the hem on the forehead, close down to the eyebrows, the point hanging down at the back of the neck. Take the two ends round the head *above* the ears, cross them at the back, bring them forward and tie on the forehead. Then draw the point gently down, turn it up smoothly over the hem and pin it to the bandage.

Fig. 12.

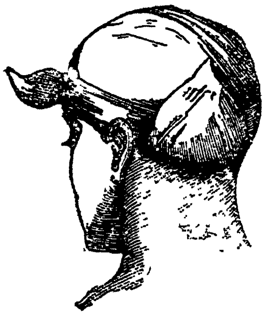


Fig. 13.

For the Shoulder.—Fig. 14.—Fold a hem as before, place the centre of the bandage on the shoulder with the point upwards, on the neck, and tie the ends round the middle of the arm. Take a second bandage, folded as a broad bandage, and make a sling for the arm, by putting

Fig. 14.

one end over each shoulder and tying at the back of the neck. The point of the first bandage is under the sling and is drawn tightly down and pinned into place when the rest is finished.

For the Hip.—Fig. 15.—Tie a narrow bandage round the body above the hip bones, take a second bandage with a hem folded, and place its centre over the wound, tie the hem round the thigh, pull the point through the narrow bandage, turn it back and pin it down.

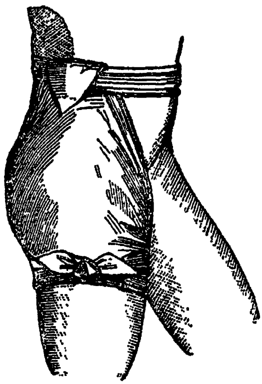


Fig. 15.

For the Chest or Back.—Figs. 16, 17.—Put the centre of the bandage over the wound, the point over the shoulder, the ends round the body. Tie the ends together first and then tie the point to one of them.


Fig. 16.

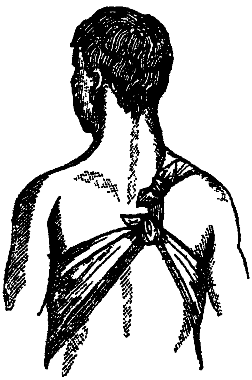


Fig. 17.

For the Arm.—Fig. 18.—Use either a broad bandage passing over each shoulder and fastened at the back, or where more support is required, spread out a bandage, put the arm in the centre with the point beyond and behind the elbow, tie the ends over the shoulder, bring the point forward and pin the bandage.

Fig. 18.

For the Hand.—Place the hand on the broad end of an unfolded bandage with the fingers towards the point fold the point back over the wrist, pass the two ends round the wrist, cross and tie them.

For the Foot.—Fig. 19.—Put the foot on the centre of an unfolded bandage, the toe towards the point, draw the point over the instep, bring the ends forward, cross and tie them either round the ankle or on the sole, if a splint is to be kept on.

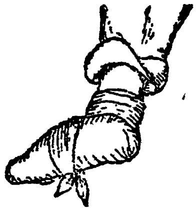


Fig. 19.

For any part of the body which is *round*, such as the forehead, arm, leg, etc., use a narrow bandage, place its centre on the wound, carry the ends round the limb, and tie over the wound itself.

N. B.—Those who wish to study the art of bandaging further can obtain a triangular bandage with figures illustrating the different modes of applying it, from the St. John's Ambulance Association, London, for six annas

Although triangular bandages can be applied to any part of the body, still there are some cases, as for instance, in bandaging on splints, when it is better and more convenient to have a roller bandage.

Roller bandages.—Roller bandages are generally made of unbleached calico, flannel or linen, and they are required of different lengths and widths according to the part they are for.

Widths of bandages.—The most convenient are shown in the following table:—

For	*Width.*	*Length.*
Finger bandages ...	$\frac{3}{4}$ inch ...	1 yard.
Arm ,, ...	$2\frac{1}{2}$ inches...	3 to 6 yards.
Leg ,, ...	3 ,, ...	6 to 8 ,,
Chest ,, ...	4 to 5 ,, ...	8 to 12 ,,
Head ,, ...	$2\frac{1}{2}$,, ...	4 to 6 ,,

Rolling a bandage.—When the bandage is torn the required width and length it has to be carefully rolled in order to apply properly. To do this, roll one end of the bandage two or three times as firmly as possible to make a beginning, then take this little roll in the fingers of both hands with both thumbs on the top of it ; ask another person to hold the other part of the bandage fairly stretched and then commence rolling it up quite smoothly and tightly, so that there is not the smallest crease in the whole length. If it is not wanted at once put a stitch or a pin in to prevent it unrolling.

N. B.—A bandage-rolling machine can be purchased at the St. John's Ambulance, London, for 2*s.* 6*d.*=Rs. 1-14.

General rules.—There are some rules which must be remembered in putting on all roller bandages, as when first applying to leave the end a little long so that when the first turn is made this end is turned back and the bandage (Fig. 20) comes over it again, thus keeping it firm and preventing it from slipping.

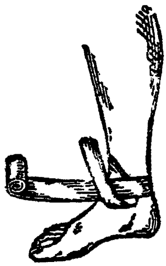


Fig. 20.

Again, always to bandage from within outwards; to commence bandaging from below and work upwards; to take care that the pressure is evenly and uniformly applied, but neither too much nor too little; to avoid all wrinkles in the bandage; in reversing or turning a bandage over, never to do so over the sharp edge of a bone, but always on the fleshy side; lastly, in fastening a bandage to stitch it or to pin it with a safety pin.

These rules hold good for all three ways of applying a roller bandage, either the simple spiral, the reverse spiral, or the figure of 8 bandage.

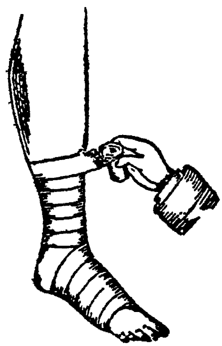


Fig. 21.

1. *The simple spiral*, Fig. 21, is applied by binding in spiral turns, each turn overlapping the under one about two-thirds of its width. This often slips out of place, so it is not as good as the reverse spiral.

2. *Reverse spiral*, Fig. 22, is put on like the first except that the bandage is turned back upon itself each time it is bound round the limb. This is done by placing the first finger of the empty hand upon the bandage at the part where the turn is to be begun, whilst the other hand turns the bandage back upon itself.

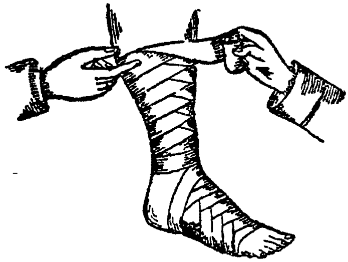


Fig. 22.

3. *The figure of 8 bandage* is the best one for joints and is always used for the ankle joint or in bandaging from the foot up the leg. The bandage is made to form a regular figure of 8 by carrying it over the upper part of the joint, then down, under, and across the lower part and then up over the upper part again.

Practise bandaging.—None of these bandages are very easy to put on the first time, so all who really wish to be able to give help and comfort to injured people, should practise bandaging on a friend until they can do it quickly and well.

CHAPTER II.

FRACTURED BONES—WAY TO TELL A FRACTURE—SPLINTS: TEMPORARY AND PROPER—WAY TO TREAT AND BANDAGE FRACTURES OF DIFFERENT BONES—DISLOCATIONS—SPRAINS—CARRYING INJURED PEOPLE.

When a bone is broken, or fractured, the person should never be moved until the part has been bound up with a splint so as to prevent the broken bone moving, the object being to prevent further mischief and especially to prevent the bone coming through the flesh.

How to tell a fracture.—One can be nearly sure a bone is broken if any or all of these signs are noticed :—

1. If the limb or part is powerless.
2. If it is painful and swollen.
3. If when it is moved gently one hears or feels a grating noise, caused by the ends of the broken bone scraping against each other, but this should only be tried for by a doctor.
4. If the shape is altered, and the limb is in an unnatural position.
5. If it is shortened.

To be able to help anyone who has broken a bone, until a doctor can set it, one must know how to fix on splints and bandages on all parts of the body.

Splints.—A splint is a piece of wood padded to make it soft on one side, and for the leg or lower arm is always longer than the *limb* itself. Splints can be made of anything handy at the time of the accident—a bamboo cane, a sunshade a long thick roll of paper, a bough of a tree, or anything that is firm enough and long enough.

Temporary splints.—An excellent pair of temporary padded splints may be made by folding a shawl, or any kind of *chadar*, to a suitable size, wrapping a piece of wood in each end, and rolling the ends towards each other until they almost meet. The broken limb is then placed between the rolls resting on the centre of the shawl, and a couple of handkerchiefs or a bandage tied round to keep them in place.

There are four kinds of broken bones where no splints can be used, those of the head, the ribs, the jaw, and the collar bone.

The best thing to do for—

1. *A Broken Skull* is to put the patient lying down on a bed, in a dark room, with the head slightly raised, and a cloth dipped in cold or iced water over the forehead and head.

2. *A Broken Jaw.*—Fig. 23.—To put the jaw gently into its proper position and apply a narrow triangular bandage round the jaw and over the head.

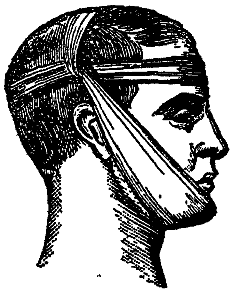


Fig. 23.

3. *A Broken Collar bone.*—Fig.—24.—To put a pad in the armpit, raise the lower arm gently and put it in a large sling, then take a broad bandage and tie the arm to the side with it as near the elbow as possible. The broad bandage must pass round the arm and chest outside the sling.

Fig. 24.

4. *Broken Ribs.*—Bind a roller bandage, four or five inches wide by six or seven yards long, round the chest to prevent the side moving, or tie two broad triangular bandages firmly round the chest making the lower part of one and the upper part of the other cover the broken bones.

All other kinds of broken bones may be put into splints and bandaged.

1. *For a broken bone of the upper arm.*—Fig. 25.—Put two, three or four splints round it from the shoulder to the elbow, and bind with a triangular bandage; put the lower arm in a sling.

2. *For a fracture in the lower arm.*—Bend the lower arm up in a horizontal position with the thumb pointing upwards and put on two splints, one on the inside

Fig. 25.

from the elbow to the finger tips, the other on the outside from the elbow to the wrist. Tie the splint with a bandage both above and below the break, and then put the arm into a large sling.

3. *For broken bones of the wrist, hand, or fingers.*—Bandage the whole hand and wrist on to a broad splint with a triangular bandage and put the arm into a large sling.

4. *For a broken thigh-bone.*—Fig. 26.—Place a long splint from the armpit to below the heel,

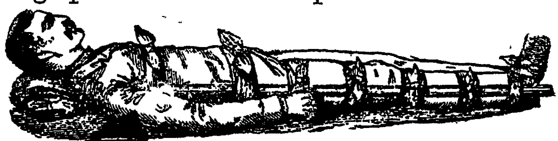


Fig. 26.

and another inside the leg from the knee to the body. Tie firmly with six bandages in different places, and when finished tie both legs together.

5. *For a broken leg.*—Fig. 27.—Put on two splints, one inside, one outside the leg from above the knee to below the heel, and tie firmly, tying the legs together afterwards as for a broken thigh.

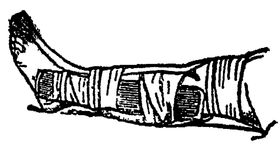
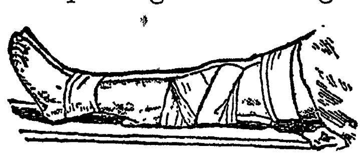


Fig. 27.

6. *For a broken knee-cap.*—Fig. 28.—Straighten the leg, raise the foot, put a long splint under the knee and bandage both above and below the knee. Tie the legs together.



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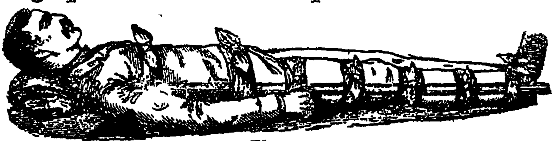

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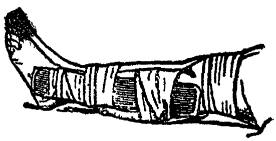

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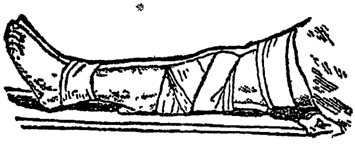

Fig. 28.

7. *For a broken foot or ankle.*—Fig. 29.—Raise the foot and put two splints, one inside and one outside, fixing them with a figure of 8 bandage.

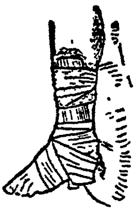

Fig. 29.

In cases where a broken bone is sticking out through the skin, the limb must be rested between a sling splint, like the pair of temporary splints described, and great care must be taken that it does not move or jar. Again, wherever there is bleeding as well as a broken bone, the bleeding, if from an artery, or a vein, must be stopped *before* the splints are put on.

Remember that these directions only help everyone to do what is best until a doctor is at hand. Putting splints and bandages round broken bones does not set them, they only prevent more damage being done. A proper doctor should in every case see the injury, and no one should allow a broken bone to be set by an unskilled or ignorant person as he does not understand how bones or joints are placed in our bodies, and often binds up a limb without allowing for the swelling, so that it mortifies or dies, and has to be cut off.

Dislocations.—Sometimes bones instead of being broken are put out of joint, that is are "dislocated."

In these cases the pain is very great, and the limb is quite helpless; but we can tell it is a bone out of joint and not broken, by remembering that—

1. The pain is always at a joint.

2. The part cannot be moved, instead of being easily moved as when a bone is broken.
3. The limb will not come into its natural position if it is pulled gently.
4. There will be no grating sound or sensation.

Treatment.—Great skill and often much force are necessary to put a dislocation right, but a great deal of pain may be saved by placing the sufferer in the most comfortable position and applying rags or bandages dipped in cold water until a doctor can be had.

Children if they are dragged along by their arms, sometimes get the arm dislocated at the shoulder joint, but of course no one who understands about our bones and joints would do anything so cruel and dangerous.

Sprains.—Sprains, which are often so painful as to cause people to faint, are accidents where the tendons or muscles round a joint are violently wrenched, and cause great pain and swelling. Cold water bandages and perfect rest are the best. If there is much swelling at first soak the part for an hour or so for the first few days in water as hot as can be borne, bandaging and resting afterwards.

Carrying people.—Stretchers.—Besides knowing how to help in accidents before a doctor arrives, everyone ought to know how to carry or move anyone who is too much hurt to move alone. If a *charpoy* is to be had, spread a piece of *durrie* or strong cloth on the ground close to the patient, lift him carefully on to it, and raise it by its four corners on to the bed. If a native

bed is not at hand a stretcher can be made by turning the sleeves of a coat inside out, Fig. 30, buttoning it down the front, and passing two bamboo poles through the sleeves.

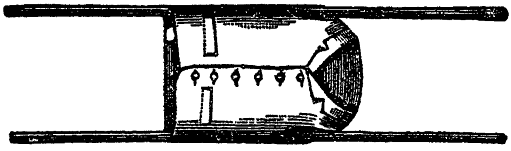

Fig. 30.

Two waistcoats, Fig. 31, buttoned up, and the poles passed through the armholes will also serve. But if nothing in the shape of a stretcher can be had or made, the patient can be carried by two people forming a seat with their hands.

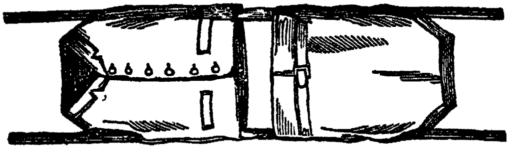

Fig. 31.

If the patient cannot walk, but at the same time is not unconscious or helpless, *a four-handed seat* made by two people clasping each other's wrists, should be used. When ready, they stoop down behind the patient, and he sits on their hands, putting one arm round the neck of each bearer.

In cases where the arms are injured, or the patient is helpless, the *two-handed* seat is used. For this two people clasp their hands with the

fingers of each interlocked and the palms upwards to form the seat, and when this is ready they make a support for the patient's back by putting their hands on each other's shoulders.

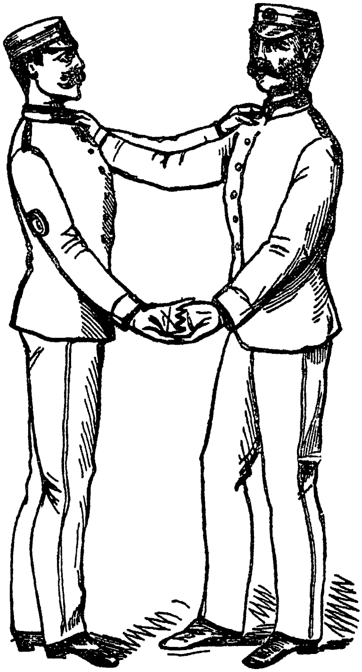

Fig. 32.

For short people or children the *three-handed seat* is the best. For this, one bearer grasps his own wrist with one hand and the second bearer's wrist with the other, whilst the second bearer grasps the left wrist of the first bearer with his left hand and places his right hand on

the first bearer's shoulder, forming the back support.

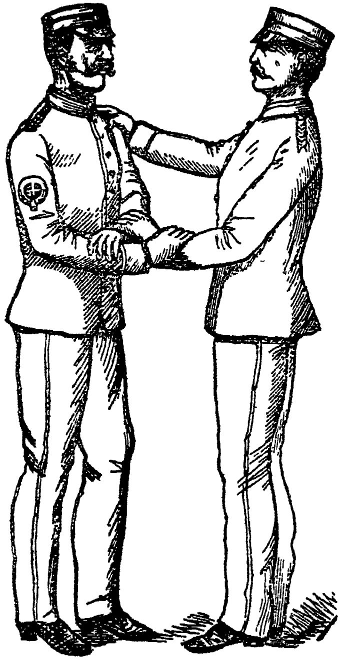

Fig. 33.

In case there is only one person to carry anyone who is quite helpless, either he must carry him simply pick-a-back, or he must stoop down in front of him, pass his right arm between the patient's legs, lift him across his back so that his arm comes in front of the bearer's left arm, and keep him from falling by holding his right leg and right arm.

CHAPTER III.

INSENSIBILITY—FAINTING—SUNSTROKE—APOPLECTIC, EPILEPTIC, AND HYSTERICAL FITS—CONCUSSION OF THE BRAIN—TREATMENT AFTER APPARENT DROWNING—SUFFOCATION FROM POISONOUS GASES—ELECTRIC SHOCK. BURNS AND SCALDS—SHOCK AND COLLAPSE—CATCHING FIRE.

Insensibility.—When people are either bleeding badly, or have broken a bone, they are often found unconscious or fainting, and when one can see that they have been injured or hurt in either of these ways, it is easy to understand why they are unconscious.

But people faint or lose consciousness from other causes as well and it is always useful to know what to do in such cases.

Various causes.—They may be in a fainting fit from fright or fatigue, or unconscious from sunstroke, or from a fit of apoplexy, epilepsy or hysteria, or from a blow to the head, although no outward wound can be seen, or again, they may be unconscious through being suffocated from charcoal fumes or poisonous gases, or from being long under water, as in drowning.

Fainting fits.—*Treatment.*—The first thing when anyone is found unconscious is to find out the cause, and the next to try and restore the person to their senses. A simple fainting fit is

generally caused by such things as sitting in a close room, going too long without food, being overtired or exhausted ; from hearing bad news, or from weakness after a long illness—and when people faint their face and lips grow white, a cold sweat comes out over the forehead and skin generally, and the pulse becomes very weak. This means that there is something wrong with the circulation of the blood in the head and the brain. The first thing therefore to do is to send the blood back to the head by placing the person lying down with the head very low, and to keep him in that position until he is better ; next, to unfasten all the clothing about the neck and chest, if it is at all tight, but not to take the clothing off round the waist in case of a chill to the stomach. If the patient is in-doors he must be taken out into the open air, or at all events have plenty of fresh air, and if he does not recover soon, the next thing is to sprinkle cold water over the head and face, to put strong ammonia or smelling salts to the nose and then to give a little brandy, or *arrac* and water, in a teaspoon, taking care that it does not cause choking.

In some parts of India people are brought round when fainting, by pressing the nose and holding the hand over the mouth so as to stop the breath. This may be good in some cases, although if anyone is suffering from the effects of bad air—that is too much carbonic acid gas, etc., it will probably do more harm than good, because it would cause still more carbonic acid to accumulate in the blood.

To prevent fainting.—If anyone feels faint, but does not go off suddenly, they may often prevent a fit by drinking a glass of cold or iced water, by smelling ammonia or acetic acid, or by sitting with the head hanging down between the knees so that the blood is forced to the head.

Sunstroke.—*Sunstroke*, again, may cause unconsciousness in people, and when this is the case it may be known by the skin being hot and dry, the eyes reddened and the pupils small, the pulse quick and the breathing loud and hurried.

Treatment.—The proper treatment is to carry the patient at once to some shady or cool place, lay him down with the head slightly raised, take off all the clothing down to the waist, and pour a stream of cold water either from a *chattie* or *mussuk* over the head, neck and chest, especially over the back of the neck. When the patient shows he is coming round, no more water is needed. He should then be dried with a cloth and rubbed all over until quite conscious again. Neither spirits nor any kind of stimulants must ever be given. If anyone is insensible for long, try packing in ice or applying ice to the back of the neck, or if no ice is to be had, put a mustard poultice or turpentine fomentation to the nape of the neck and feet. As soon as he can swallow, give plenty of cold water to drink, and a dose of quinine followed by some opening medicine.

Heat fainting is a very mild kind of sunstroke. The patient is not quite insensible but is giddy sick and shivering, and should be laid on his

back, the clothes loosened, the limbs rubbed and a glass of cold water given.

Apoplexy.—*A fit of Apoplexy* caused by the blood pressing on the brain is another thing which makes people insensible, and we may know that it is an apoplectic fit, and not sunstroke or mere fainting, by the following signs :—

Symptoms.—The breathing is very heavy, with a noise like snoring, and with one cheek puffed out ; the face is flushed and the pupils of the eyes are *unequally* contracted or enlarged. Nothing will rouse the patient, and if the arms be raised, one will generally fall a dead weight and powerless, whilst the other may show signs of feeling.

Treatment.—The great thing is to move the patient as little as possible, but to place him lying down on the first sofa or bed that is at hand, with the head and shoulders well raised ; loosen the clothing round the neck, put hot bottles, or flannels, or mustard plasters to the feet and legs, and sponges or rags dipped in cold water to the head—but to give no spirits, stimulants, emetics, or anything by the mouth. The chief object in the treatment is to draw down the blood from the head and prevent further bleeding from the broken blood vessel inside the brain—that is why cold must be applied to the head, heat to the legs, and the patient moved as little as possible.

Epilepsy.—*Symptoms.*—In *fits of Epilepsy* people become unconscious so suddenly that they fall down, sometimes with a piercing scream,

on the spot, and so are often badly hurt by falling against something hard, or into a fire. Convulsions, foaming at the mouth, and biting of the tongue generally follow; whilst the hands are tightly clenched, the legs and arms jerked violently, and the breathing becomes so difficult that people turn black in the face. In some cases when the convulsions cease the patient gets up and walks away, at other times he falls asleep.

Treatment.—For treatment, raise the head with a pillow or roll of cloth—place something hard, such as a piece of wood or cork between the teeth, so that the tongue will not be bitten—prevent the patient hurting himself, but do not hold him down with any great force—undo anything tight and let him get to sleep as soon as possible.

Hysteria.—*Treatment.*—In *Hysterical fits*, such as girls and women sometimes have, the patient generally falls down in some comfortable place, and not suddenly in a dangerous place as in epilepsy—she clenches her hands—grinds her teeth and laughs, cries and screams by turns. Cold water on the face is the best treatment, telling the patient at the same time that if the fit continues she must be drenched with cold water.

Hysteria generally comes from real or fancied weakness; and plenty of fresh air, exercise, and a good tonic will in most cases stop it.

Signs of concussion..—*Treatment.*—In *concussion of the Brain*, where people are stunned by blows on the head, or by falling from a great

height, they may be either much hurt or only a little. If they are much hurt the signs are like those in apoplexy and the treatment should be the same; but if only slightly hurt the patient will be lying with the eyes shut, looking very pale and breathing slowly; if spoken to he will probably wake up as if from sleep and answer sensibly, dropping off again directly into half unconsciousness; perhaps after a few minutes he will be sick and then slowly recover. The best thing to do in such cases is to put the patient lying down with the head a little raised—give him plenty of fresh air—apply heat to the feet and hands, and cold to the head—and as soon as he can drink give a cup of warm tea or coffee.

Apparent drowning.—When anyone is taken out of a well, river, or any water, even after immersion for 10 or 15 minutes, and seems dead because quite unconscious, it is often possible to prevent their death by restoring the breathing, and after that by restoring their warmth and circulation.

Even when people have been apparently dead for as long as three hours their lives may be saved if people will remember what to do until the doctor comes.

To restore breathing.—The first thing to do is to get rid of the water, mud and froth in the air passages, and then to restore breathing artificially—this is best done by Marshall Hall's method:—

(*a*) Release the clothing around the neck and in front of the chest and clean out the mouth and throat with the fingers.

(*b*) Turn the patient on his face, put a pad under the chest and rest his forehead on his right forearm.

(*c*) Now press with your hands well extended against the patient's back over the lower ribs for three seconds.

(*d*) Now draw the patient on to his right side and keep him there for three seconds.

(*e*) These movements must be alternately repeated till water and froth no longer flow from the mouth ; but to completely restore breathing although this method should suffice Sylvestre's may be resorted to as now to be described :—

Turn the patient on his back with a pillow or a substitute for it underneath his shoulder blades, so that the head hangs over a little and the neck is extended.

Having done this, begin to imitate the movements of breathing, Fig. 34. Stand at the patient's head, take hold of the arms by the

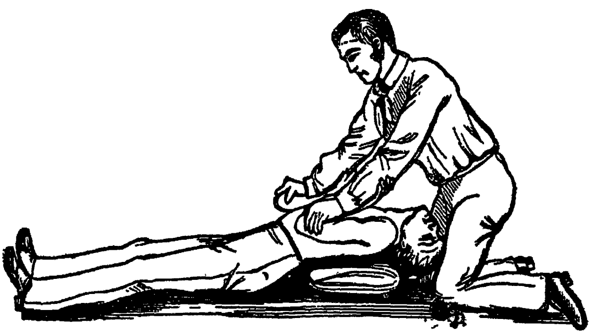

Fig. 34.

elbows, and draw them slowly and steadily upwards until they meet above the head. Keep

them in this position for 2 seconds, so that air will be drawn into the lungs, because when the arms are up the ribs stretch out and the lungs can hold more air.

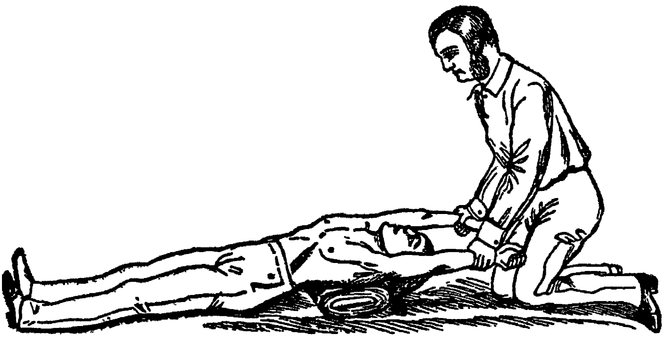

Fig. 35.

Then draw down the arms, Fig. 35, and press them firmly for 2 seconds against the sides of the chest so that air is pressed out of the lungs. Repeat these movements by turns, slowly and steadily about 15 times every minute, until either the patient breathes naturally, or a doctor arrives and declares him dead. If a second person is present he should put snuff or smelling salts to the nose, rub the chest and face briskly, dash cold and hot water by turns on the chest; or flap it with a wet towel and rub the body and legs with flannel or cloth.

This plan of restoring breathing is called after its inventor, Dr. Sylvestre's, and is the simplest and best to learn because it does not require any great skill, and because *one* person can do it alone if no help is near.

Warmth and Circulation.—After natural breathing has been restored, the warmth and circulation must be attended to.

The patient should be wrapped in warm, dry blankets, and the legs and arms rubbed *upwards* with flannels, or rough dry bath towels, so that blood is helped along the veins to the heart. At the same time put hot bottles or bricks, or bags of warm sand, to the feet, to the pit of the stomach, and to the armpits. As soon as the patient is well enough to swallow, give small quantities of spirits and water, or wine or coffee, put him to bed, and get him to sleep if possible. If there is pain or difficulty in breathing afterwards, put a hot linseed-meal plaster on the chest and on the back below the shoulders.

Precautions.—In addition to this, it is necessary to remember not to let people crowd round the patient, especially if indoors; not to let him remain lying on his back unless the tongue is pulled out; never to hold the body up by the feet; and never to put the patient into a warm bath unless the doctor orders it.

Suffocation.—*Treatment.*—In *cases of suffocation* by smoke, charcoal fumes, poisonous gases from a well, and such like, the first thing is to get the patient into the open air, to undo all tight clothing, and then to treat as before; first to restore breathing, secondly to help the circulation. The treatment should be kept up for one or two hours at least or until the doctor arrives.

In case of a fire anyone going to the rescue must remember before entering a building full

of smoke to tie a handkerchief—wet if possible—over the nose and mouth and also if possible, to have a bucket of water thrown over his clothes, then to keep low and bend or crawl into the room as the smoke is least near the floor. Directly the suffocated person has been got into the open air commence artificial respirations.

Electric Shock.—Contact with an electric-cable may produce very severe shock, insensibility or death. It will probably be necessary to release the victim and anyone going to his aid must be very careful not to get a shock himself. To ensure this he must wrap his hands up in some non-conducting material, such as dry grass, dry silk, dry cloth or best of all put on India-rubber gloves or if nothing is at hand take off his coat, and use the sleeves to protect his hands—at the same time insulating himself from the ground by standing on a material of a like description or dry wood or bricks. Anything wet should be avoided as any dampness tends to offer an easy road for the passage of an electric current. If for want of any of these things the hands cannot be used, then a bamboo pole or other piece of dry wood may be used to push the sufferer or a *pugri* to pull him away from contact. All the common metals, such as brass, copper, etc., are good conductors, and should never be used in this connection. When no longer in contact the patient is found to be insensible but breathing, flicking the face and chest with a wet towel will probably be sufficient to restore animation. If breathing is absent some form of artificial respiration

should be resorted to ; that known as Laborde's has been found useful in such cases. This consists in first depressing the lower jaw and then having grasped the tongue with your hand covered with a handkerchief to keep it from slipping, to pull it forwards for 2 seconds, then allow it to recede for the like period and so alternately, the patient all the time lying on his back or side. Where there are burns they must be treated after respiration has been restored. In very severe cases it is well to remember that artificial respiration if persevered in for 2 hours can result in recovery.

Burns and Scalds.—First of all remove all burnt clothing which is not sticking to the burnt surface. Do not pull it, but cut it away and leave parts that have stuck alone ; these must be floated off by bathing with warm water to which some bicarbonate of soda has been added. Only portions of the burnt surface should be uncovered at a time, *i.e.*, if it is at all extensive, and these should be covered quickly again with small pieces of gauze or soft clean linen or cotton ready spread with pure vaseline to which boracic acid powder has been added or with carron oil (equal parts of lime water and sweet or linseed oil). Over the dressings must be placed cotton wool or flannel, and the whole kept in position by means of bandages lightly applied. After the first properly applied dressing the parts should be disturbed by fresh dressings as little as possible so as to permit the raw surface to be glazed over by new tissue as soon as possible. If the burn is from a corrosive acid the part should be

bathed with a weak solution of bicarbonate of soda in warm water, or if from a corrosive alkali with a weak acid lotion such as one consisting of equal parts of vinegar and water.

For scalds in the inside of the mouth and throat, steam as hot as can be borne must be at once inhaled.

Shock and Collapse.—After extensive burns and especially those about the chest there is often great shock and collapse.

These conditions require treatment before the dressing is attended to; they are known by extreme paleness, cold clammy skin, feeble pulse and a semi-conscious condition. There may be fits of shivering or a cold sweat. Under these circumstances the patient should be at once put to bed with the head low and with hot water bottles and flannels to the extremities and pit of the stomach, and perhaps a mustard poultice over the heart. If the patient is conscious enough to swallow, hot drinks with sugar in them (this tends to raise the temperature) should be given in small quantities.

Clothes catching fire.—If anyone is alone and their clothes catch fire, they should lie down on the floor or ground with flames uppermost, roll themselves up in a *durrie*, or rug, or any thick thing, and call for help. No one whose clothes are on fire should rush out into the open air. If anyone else is at hand let them throw a rug or blanket over the person who is on fire, and roll them on the floor until the flames are out. The chief thing is to keep out the air as fire cannot exist without oxygen. If we remember this it

will help us to keep our heads cool, because directly anyone is completely covered up and the rug pressed tightly round them we know the flames must go out.

In all these cases lives may be saved by remembering what to do, but if a doctor can be had he should be sent for at once and the treatment gone on with until his arrival.

CHAPTER IV.

SNAKE BITES—BITES FROM ANIMALS—PASTEUR TREATMENT—STINGS—BRUISES— SWALLOWING INJURIOUS THINGS—CHOKING—POISONS AND THEIR ANTIDOTES.

Besides such accidents as those by which blood is lost, bones are broken, or people become insensible, there are others which are continually happening around us, and which everyone should know how to treat. Amongst these are :—

Snake bites.—*Treatment.*—At the moment of the accident it is often not known whether the snake is poisonous or not. In every case therefore—

1. Tie a handkerchief, cord, or string tightly round the limb about two or three inches above the bite. Put a piece of stick under the cord and twist it until it is as tight as possible. Do not be afraid if the limb becomes swollen and discoloured below, but bind tightly so that no blood can pass to or from the part.
2. Tie two or three other cords above the first a little distance from each other, and tighten them also.
3. Make a cut about a quarter of an inch deep right across the bite and let it bleed well.
4. Put a hot iron or red hot piece of charcoal or wood right into the wound, or rub in crystals

of permanganate of potash, or fire gun-powder into it, whichever can be done quickest.

5. Suck the wound hard, spitting out the blood each time until the hot iron or caustic is obtained.

6. If the bite be on a part that cannot be tied up with a cord, pinch up the skin over the bite, and cut out a round piece about the size of a finger nail and half an inch deep—then put the hot iron or caustic to the raw surface.

7. Give a wineglassful of brandy, or brandy and sal-volatile, every quarter of an hour. Three or four doses are generally enough as the patient must not be made drunk.

8. If no symptoms of snake poisoning appear in half an hour loosen the cords, but if poisoning symptoms do appear keep them on until the patient is recovering.

9. Do not let the patient move about, keep him quiet and cheer him. If he becomes very low, apply mustard poultices and hot bottles over the heart and to the stomach respectively—rub the limbs and try artificial respiration as after drowning.

It must always be remembered that the person bitten may get prostrate from fear even when the snake is quite harmless; therefore those who are treating him should never give up the hope of saving him, especially if after half an hour no marked symptoms of poisoning have shown themselves.

Bites from dogs, jackals or cats.—If the animal is mad or is supposed to be, the following

directions issued by the Pasteur Institute, Kasauli, should be observed :—

As regards the animal, it should not be destroyed but carefully chained up in a closed room and observed for ten days ; if it remains well for that period after it has bitten anyone the bite may be considered harmless as far as rabies is concerned. If found to be "mad" then any dog known to have been bitten by it should be killed, as also any puppies being fed by their mother in a similar case. This is necessary as the disease may not appear in a dog for from three weeks to several months after it has been bitten by another.

Any of the following signs may indicate the presence of rabies in a dog :—

(*a*) Skulking and changed demeanour or a tendency to snap, bite or attack unprovoked other animals or human beings. It may at the same time exhibit signs of affection towards and no inclination to bite its own master. (*b*) Tendency to stray from home. (*c*) Perversion of appetite. (*d*) Paralysis of the lower jaw. Paralysis or weakening of the extremities. (*e*) Escape of frothy or ropy saliva from the mouth. (*f*) Altered character of the bark. (*g*) Proneness to attack savagely a stick or other object held out towards it. Biting at imaginary objects, tearing up the ground in its neighbourhood.

Fear of water is not a symptom of this disease in animals ; inability to eat or to lap fluids may not appear till very late in the disease.

As regards the person bitten, the wound should at once be washed, and after being dried it should

be thoroughly cauterised with pure carbolic acid, permanganate of potash crystals or some other caustic ; if the caustic is fluid it should be deeply applied by means of a match or other piece of wood. On its being decided that the bite was caused by a "mad" dog or other animal, the patient should be advised to go at once to obtain treatment at a Pasteur Institute.

Prevention, however, is better than cure, and so it is as well to remember the rules issued by the Kasauli Institute in this connection :—

(1) Let no one allow his own or any other dog to lick him.

(2) Let no one allow his dog to sleep on his bed. This comes to very much the same as (1).

(3) Let everyone treat a sick dog as a rabid dog. Let him be particularly careful in the administration of medicine to a dog, no matter what the disease is which he supposes it to be suffering from. More particularly still let him avoid examining, without due precaution, a dog for a supposed bone in the throat.

Stings of scorpions, venomous insects, etc.—Try to get the sting out by pressing a small hollow cane or watch-key over it ; then put a paste of ipecacuanha powder and water on the place, or rub in ammonia, or ammonia and oil. When none of these can be had put rags on, dipped in vinegar and water, or strong salt and water. If the patient feels faint, give some brandy and water, sal-volatile, or wine.

Stings at the back of the throat or inside the nose.—Let the patient inhale steam as hot as can be borne.

Bruises.—If the skin is broken, bind up with a cold water or an ice bandage; if the skin is not broken, but is only "black and blue," put on a rag dipped in arnica lotion, or if there is no arnica plain cold water or weak vinegar and water.

Swallowing small articles, as buttons, or pice.—If the thing has only just been swallowed give an emetic of salt and water, or mustard and water, to cause sickness; or beat the whites of three eggs with a little water and let this be drunk at once, followed by a dose of ipecacuanha five minutes afterwards. White of egg hardens or coagulates in the stomach, and if it closes round the thing that was swallowed may bring it away at once. If it is too late to be brought up by the mouth, let it alone and send for the doctor. If no doctor can be had do not give opening medicines. It is better for the patient to eat a lot of coarse thick food such as *dal bhat.* The button or pice then becomes embedded in it and passes through the bowels without any trouble.

Even a pin may go safely through in this way, provided no castor oil or medicine is given until after plenty of food.

Choking may occur either from swallowing things like the above, or from a fish bone, or something else sticking in the throat. If it cannot be got up or pushed down with the finger, either eating a large mouthful of rice or bread, or drinking a good draught of cold water, will generally carry it away.

If a child chokes through a marble, nut, or anything getting into the *wind-pipe*, he must be held, face downwards, and the back gently tapped until whatever it is comes up again.

Lime and other things in the eye.—Wash the eye inside and out with vinegar and water until the lime is all out.

If simply grit gets into the eye it is easy to remove it from the under eyelid by merely pulling the lid down and taking the grit out with a small piece of clean cloth screwed up into a point, or with the tip of the finger, either wetted or smeared with a little oil or glycerine.

But if anything gets inside the upper lid, it is not so easy to get it out. The best plan is to press something hard, such as a pencil, or fine piece of wood across the outside of the lid at the top and then by taking hold of the eye-lashes turn the lid inside out over the pencil or wood. If the substance is sticking to the lid it can then be removed but if it cannot be found a little pure glycerine dropped into the eye will make it water so much as to wash away the grit; or if the eyes are opened and shut several times under cold water, it will perhaps have the same effect.

When a piece of steel gets in the eye drop a little olive or castor oil on the eye-ball, close the lids, put a soft pad of cotton wool on, tie a bandage round and take the patient to a doctor.

Things in the ear.—When anything gets into the ear, it is generally best to leave it alone, and let it work its own way out, or if it causes pain first try floating it out by putting warm

water in. Never syringe or probe, but have further treatment from a doctor. Great care is necessary in the case of the ear to prevent the thing being pushed further in, as it may press on the drum and cause serious inflammation with perhaps permanent deafness.

Things in the nose may generally be dislodged by blowing the nose violently or by giving a pinch of snuff or pepper, to make the patient sneeze, or by sniffing up water or syringing out the nostril with water.

Poisons.—There are many different kinds of poisons, but it is quite enough for general use to remember there are two principal kinds—irritant and narcotic.

Irritant Poisons are generally easy to tell because the lips, mouth and tongue are burnt or stained and the patient is in intense pain.

Narcotic Poisons which act on the brain make people either stupefied, unconscious, or delirious.

Treatment in poisoning.—The four chief things to remember when anyone is found poisoned are:—

(1) To send for the doctor.

(2) To get rid of the poison by making the person sick.

(3) To give an antidote to stop the poison doing further harm.

(4) To try to prevent death by different remedies.

The best way to make any one sick is to give an emetic, or to tickle the back of the throat with a feather, fine brush, or the finger.

Emetics.—Emetics must never be given when the mouth and lips are stained by a corrosive fluid. The chief emetics are :—

Good draughts of warm water. A table spoonful of salt or a dessert spoonful of mustard in a tumbler of warm water. One or two table spoonsfuls of ipecacuanha wine or powder in warm water, or when stronger ones are required sulphate of copper or zinc.

Having made a patient sick, the next thing is to find out, if possible, what poison has been taken, and to give the proper antidote.

General Rules.—If the patient can speak, ask whether the taste in his mouth is *acid*, like vinegar or lemon juice ; or *acrid*, that is bitter, sharp, or biting, like the taste of soda or lime.

Acid : any alkali will do as an antidote.

Acrid : any acid will serve the purpose.

Or in other words, if the taste is *acid*, give magnesia, or chalk and water, or wall plaster mixed with water, or soap suds or lime (*chuna*), or potash or carbonate of soda mixed with plenty of water ; or milk, if none of these are at hand ; whilst, if the taste is *acrid*, give vinegar, orange or lemon juice, tartaric acid in water, or olive oil in large quantities.

Rousing insensible patients.—If the patient is not able to speak, and is either drowsy or insensible, the first thing to do is to wake him up by dashing cold water on his head and face and then to keep him awake by giving him strong coffee to drink, and making him walk about. If this has no effect and his breathing grows fainter and fainter, the chest must be

smartly rubbed with a cold wet towel and artificial respiration, as after apparent drowning must be used. People can often be roused in this way even when they seem almost dead, the same as when they are unconscious for long after being nearly drowned.

Common poisons.—Apart from these general rules it is as well to know a little more in detail about a few of the more common poisons in India, especially arsenic, opium and *dhatura.*

Arsenic is generally used for murder. It is colourless and almost tasteless, so can easily be mixed without being detected.

Opium is used for suicide or infanticide chiefly and *dhatura* to conceal robbery or sometimes to kill people.

Arsenic poisoning.—*Treatment—Antidotes—Arsenic* (*Sammulfar—Sankhya—Hartal—Mansil*)—The *symptoms*—which usually begin from half to one hour after taking the poison—are sickness, often of a blue or black colour; burning pain in the stomach; great thirst; diarrhœa; sometimes cold skin, cramps and sleepiness. In treating a patient, if he is already sick from the poison itself, give him large draught of warm water to make him more so. If he is not sick give him a mustard, or salt-and-water emetic every quarter of an hour till he is sick, or if this and tickling the throat both fail, 5 grains of ipecacuanha powder and for a child a teaspoonful of ipecacuanha wine every quarter of an hour until sickness is produced. After the sickness give as an antidote, either new milk or milk and oil, the white of raw eggs, linseed

tea, oil and lime water, followed later on by a dose or castor oil, or *kaladana*.

Copper degchies.—Poisoning from the green rust of copper *degchies* or vessels causes much the same kinds of symptoms, and the same remedies are good.

Opium.—*Symptoms.*—*Treatment.*—*From opium* poisoning (*afium* and *afin*) there is generally no sickness as from arsenic, and nearly always deep sleep. The symptoms which begin from half to one hour after taking the poison are sleepiness or complete insensibility, small pupils of the eyes, great perspiration and clammy skin, very seldom any vomiting. The proper treatment is to give an emetic as quickly as possible, and to continue it every quarter of an hour until the stomach is well emptied, or until there is no smell of opium in what comes up. After the emetic strong coffee must be given every 20 minutes until the eyes begin to open and the patient must be kept awake by dashing cold water over him or walking him about.

Dhatura.—*Symptoms.*—*Treatment.*—In *dhatura* poisoning the *symptoms*, which begin from 5 or 10 minutes to half an hour after taking it, are sleepiness, enlarged pupils, giddiness, delirium unconsciousness but rarely sickness. The first thing is to make the patient sick, but if he cannot swallow, first drench his head and spine with cold water from a *bhistie's mussuk* for 3 or 4 minutes, and then if he becomes conscious give him an emetic. If the patient is much exhausted after this, give small quantities of rum-*sharab*, about one *chittack* every hour, or

oftener, if there is any risk of his dying from exhaustion. If he lives for a day, half a *chittack* of castor oil or 30 or 40 *kaladana* seeds should be given as a purge.

Dhatura seeds, it must be remembered, are rather like red pepper to look at, but give a bitter taste to any food they are mixed with.

In addition to these, Aconite and Nux Vomica are fairly common poisons.

Aconite.—*Symptoms.*—*Treatment.*—In *Aconite* (*bish*) poisoning, the *symptoms*, which come on in about 15 minutes, are numbness and tingling in the mouth and throat and afterwards in the limbs—frothing at the mouth, sleepiness and occasionally convulsions, or delirium, or paralysis.

The first thing, again, with this poison is to make the patient sick by an emetic ; next, about an hour after the poison has been taken, give half a *chittack* of castor oil or two castor oil seeds in milk. If he is very weak give rum-*sharab*, every quarter of an hour, or strong hot tea, or if that is not to be had, catechu (*kuth*) in the dose of two *ruttees* dissolved in hot water ; where the limbs are cold or cramped they must be rubbed with hot cloths.

Nux Vomica.—*Symptoms.*—*Treatment.*—In *Nux Vomica* (*kuchila*) poisoning, the *symptoms* come on in from a quarter to one hour and are twitching in the limbs followed by violent spasms and often lock-jaw. The spasm usually effects the whole body, ceases for a time and then returns. The treatment is an emetic at once, then one ounce or more of animal charcoal mixed

with water. Tea, linseed tea, or infusion of catechu are good if taken in great quantities and very strong; and small doses of opium, chloroform or tobacco juice are useful for relieving the spasms.

Carbolic Acid.—The lips and mouth are generally stained white and nervous symptoms come on whilst the odour of the breath may suggest this poison. The treatment is to give milk, mixing half an ounce of epsom salts to a pint of milk; no emetic must be given, but something soothing as salad oil or raw eggs.

Ptomaine poisoning, i.e., poisoning from meat, fish or fungi.—The signs are vomiting, purging (diarrhœa), colic, great weakness, headache, raised temperature and a quick pulse. An emetic should be given at once, followed by a dose of castor oil when this has acted. If collapse occurs this must be treated as previously described.

Be careful to preserve any vomited matter or food suspected of containing poison and do not wash vessels which may have contained it.

CHAPTER V.

SYMPTOMS AND FIRST TREATMENT OF ILLNESSES —BRONCHITIS—CHOLERA—COLIC—CONSTIPATION—CONVULSIONS—CROUP—DIARRHŒA—DYSENTERY—INFLUENZA—FEVER AND AGUE—SMALL-POX.

To know how to do the right thing when anyone is taken suddenly ill is as important as knowing what to do in any accident, or any of the other emergencies we have learnt about.

Symptoms of illnesses.—The first great point is to be able to tell one illness from another. This is done by noticing what are called the *symptoms* or signs. Each illness has more or less special signs, and these must be learnt and remembered quite as much as the remedies which are to be given.

First remedies.—The remedies here mentioned it must be remembered, are only "first helps," that is, for the beginning of each illness before the doctor can come. They may often save lives if properly applied, but they will not do to give day after day in long illness.

The illnesses mentioned are only a few which it does not do to neglect, and which must be treated at once if possible.

In **Bronchitis,** that is inflammation of the lining of the bronchi of the lungs, the *symptoms* are at first like those of a common cold,

afterwards there is a moist, loose cough, fever and restlessness and wheezing, or rattling sounds in the breathing. If it is treated in time probably only the large tubes will be inflamed, but if neglected and it spreads to the smaller tubes it becomes very dangerous.

Treatment.—Put the patient to bed, clothed entirely in flannel and with the head well raised on a pillow, give an emetic of ipecacuanha and put a large bran jacket-poultice both before and behind the chest. Keep the air in the room warm and moist by means of steam brought well into the room from a kettle with a long spout. If a long-spouted kettle cannot be had, a tube to fix on to the spout of an ordinary kettle may be made of thick brown paper rolled and tied into shape.

In Cholera, the *symptoms* are :—

(1) Bad diarrhœa of the ordinary colour at first but soon becoming rice-watery in appearance.
(2) Severe vomiting.
(3) Intense thirst.
(4) Cramps.
(5) Suppression of urine.
(6) Rapid cooling of the skin and emaciation.

Treatment.—Put the patient in a warm bed, with hot bottles to the feet and armpits, avoid chills, give iced soda-water or barley water in small quantities to relieve thirst. For the cramps rub the parts briskly with powdered dry ginger. While the stools remain a natural colour a single dose of 15 drops of the chlorodyne

or 20 of tincture of opium (laudanum) may be given in a little water. As long as the pulse remains fairly good from a half to one pint of warm water containing $1\frac{1}{2}$ drams of salt should be injected into the rectum every two hours slowly by means of a long soft tube to replace the loss of fluids and salts. The best medicine to give is a solution of six grains of permanganate of potash or preferably of permanganate of calcium to a pint of water, two or three ounces at a time, and repeat it as frequently as the patient can conveniently take it. This drug can also be given as a pill either with or without the fluid.

As the *symptoms* begin to abate care must be taken not to attempt to check the diarrhœa, no milk or soups should be given, but only thin arrowroot and cornflour; later when the acute diarrhœa ceases whey can be tried. Alcohol should not be given in any form, but sal-volatile should be when the acute symptoms have passed off.

In **Colic** the *symptoms* are pain in the abdomen about the navel but no fever. The patient draws his legs up or bends forward, or presses something against the stomach to relieve the pain.

Treatment.—A tablesponful of castor oil with 15 drops of laudanum to a grown-up person or for a child ten drops of the sweet spirits of nitre in a teaspoonful of caraway or aniseed water. Put the patient to bed, and apply hot fomentations to the stomach.

Constipation means the acting of the bowels at long intervals or unsatisfactorily. If allowed

to continue for many days it may lead to inflammation, resulting in death.

Treatment.—The safest plan is to give an enema of warm water or soap and warm water; or for a baby an enema of one teaspoonful of glycerine.

In **Convulsions** in children. In some cases "there are warnings" of the approach of a fit, such as twitchings of the face, startings during sleep, or doubling of the fingers over the thumbs. In others a child goes straight off into a fit, it becomes deadly pale, stares and rolls its eyes about, the breathing is irregular and catching, the body becomes stiff and the hands are clenched.

Treatment.—If the child is not in high fever give it a hot bath immediately, then an emetic of one teaspoonful of ipecacuanha wine every quarter of an hour till sickness is produced. Try to get the bowels to act either by an enema or a dose of epsom salts or senna. When the fit is over keep the child in a cool atmosphere and soothe it to sleep.

If in high fever put the child at once up to its neck, no matter whether dressed or undressed into a warm bath and gradually cool down by adding cold water, and pour cold water on its head until consciousness returns.

In **Croup**, the *symptoms* are sometimes a slight cold or cough with a little fever, followed by the peculiar sound in the throat like the crowing of a cock, which is caused by the opening of the throat narrowing suddenly and violently each time the child breathes. At other times it comes on suddenly without any warning.

Treatment.—Give an emetic of ipecacuanha every quarter of an hour until sickness is produced, put the child in a warm bath for ten minutes, dry it well, wrap it up in flannel or something woollen, and put it to bed; keep the air of the room warm but damp by boiling a kettle, as in bronchitis, and letting the steam from it mix with the dry air. Steam should also be inhaled from a jug of hot water, if possible. Fomentations made by wringing out sponges in very hot water are also excellent to apply round the throat.

In **Diarrhoea** the *symptoms* are well known—the bowels act very often and only watery motions are passed.

Treatment.—Put the patient to bed and apply warmth to the abdomen. If the diarrhœa is due to irritating material in the bowel and is accompanied by pain to children give a teaspoonful of castor oil or syrup of rhubarb and to grown-up people a tablespoonful of castor oil with 15 drops of laudanum.

If the diarrhœa is due to a chill ten drops of laudanum or chlorodyne may be given to an adult every three or four hours, but as a rule astringents such as lead or kino should not be given without a doctor's advice as they may make the diarrhœa worse or even cause inflammation of the bowel. In an infant if the diarrhœa is at all severe milk should be stopped for many hours (12 to 24 at least), and barley water or white of egg and water should be given instead in small quantities every hour or so. In older children a similar line of treatment is to be

followed, but the patient may be allowed boiled milk diluted with barley water.

Never neglect diarrhœa and always see a doctor about it.

In **Dysentery**, which is inflammation of the glands of the large or lower intestine, the *symptoms* are like those of griping diarrhœa, getting worse as the bowels act again and again, until at last almost nothing but bloody slime is passed, and that with great pain and straining.

Treatment.—Put the patient to bed and see that he does not get out for anything ; he must be made to use the bed-pan each time he has a call to go to the stool. All solid food must be stopped and for it you must give barley water, eggalbumin, whey or rice water in small quantities frequently. These should be given warm as if too hot or cold there will be a tendency to excite an action of the bowel.

A tablespoonful of castor oil with 20 drops of laudanum should be given at the commencement of an attack, and this can be followed by either a large dose of ipecacuanha powder or repeated doses of epsom salts. If ipecacuanha is given no food should be taken for three hours, then 20 drops of laudanum must be swallowed in a little water and a mustard plaster applied just over the stomach. In 20 minutes 20 grains of the ipecacuanha floated on half a wineglassful of water are given, care must be taken that the patient lies flat on his back and does not move about or he will probably bring the medicine all up again. If salts are given then one dram preferably of the sulphate of soda, or failing

this the sulphate of magnesia, may be given in a little warm water until a purgative effect is produced, and then sufficiently often to keep up a gentle action until the blood and mucus disappear. If there is the least suspicion of malaria being present five grains of quinine should be given twice daily.

For children castor oil emulsion or smaller doses of sulphate of sodium may be given.

Bael drink is also a good thing to give.

Dysentery should always be treated *at once*, as delay often causes a long illness ending in death.

Influenza.—In this disease you get a feeling of depression, head and back ache, pains in the muscles, sore throat and cough, with sometimes pain in the pit of the stomach and diarrhœa and vomiting, accompanied by considerable fever. The patient should be kept warm in bed in a well-ventilated room and not allowed to get up until the temperature has been at normal for at least a day.

In *Malarial fever* and *Ague*, the *symptoms* are well known. There are pains in the head, legs and body, the patient is first hot and then cold, one moment shivering and the next at fever heat.

Treatment.—Put the patient to bed wrapped up warmly, give some opening medicine, castor oil or *kaladana* and cream of tartar mixture followed by 5 grains of quinine when the bowels have acted. Give hot lime-juice and water with a little ginger in it during the shivering fits; in the hot stage apply cold water to the head and give a cooling drink, and as soon as perspiration

sets in give a hot cup of tea or coffee and 5 or 10 grains of quinine to be repeated two or three times a day. It is most effectual when given in solution with an acid such as lime-juice.

To prevent fever and ague whilst living in unhealthy districts take 3 to 5 grains of quinine regularly daily, preferably in the evening.

But if the bowels are constipated or the liver is out of order take a 5-grain Blue pill at night, followed by 3 drams of sulphate of magnesia, or epsom salts the next morning.

Euquinine which is tasteless can be given instead of quinine to children, or quinine can be mixed up in *cacao* butter or in a tablespoonful of milk after the mouth has been lubricated with a morsel of bread and butter.

It can also be given by enema.

Plague.—This disease is known by the rapidity with which the symptoms set in and their severity : these are high fever, great depression, headache, vomiting, reddened eyes and face with the dulled expression and unsteadiness of the intoxicated or drugged man. Soon after these signs appear, very tender swellings will be found in the groin, armpits or neck or in some cases—and these are those most to be feared on account of their infectiousness—there are symptoms of inflammation of the lungs. The treatment consists in putting the patient in the open air or a well-ventilated room and in keeping him in perfect rest in bed until he is quite strong, good nursing, frequent nourshing, easily digested fluid diet and such medicines as the doctor orders.

In Small-pox the *symptoms* are fever, shivering, sickness, headache and backache. On the third day small red pimples, or in other words the pocks, begin to show, first on the forehead and face, next on the wrists, and then on the body and legs. The rash consists of very hard, red pimples until it is 48 hours old, and then a little liquid shows in the centre of each ; 48 hours later again each pock has become a yellow colour and the fluid has changed into matter. The rash is at its height on the eighth day.

Treatment.—The first thing to do directly the disease is known is to keep the patient away from everyone but those who are to do the nursing. Choose a cool, well-ventilated room, or better still a tent in cold weather for fresh air is one of the best things to secure a good recovery and put the patient to bed with light but warm clothing on and be careful to keep the temperature of the body up when there is a tendency for it to fall by hot water bottles if necessary.

Begin by disinfecting everything from the first, and put plenty of disinfectants about the room and everywhere near it. Give water, lime-juice and water, or some cooling drink, with milk and arrowroot, milk and rice, bread and milk and beef tea as the principal foods. Sponge the body with water or vinegar and water to soothe the irritation of the skin and powder it lightly with a little Fuller's earth, or rice powder.

Bathe the eyes every day to keep them thoroughly clean, and if the lids stick together apply some simple ointment.

Conclusion.—At all times let everyone remember that "Health is Wealth," "Prevention is better than Cure," and that "God helps those who help themselves."

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